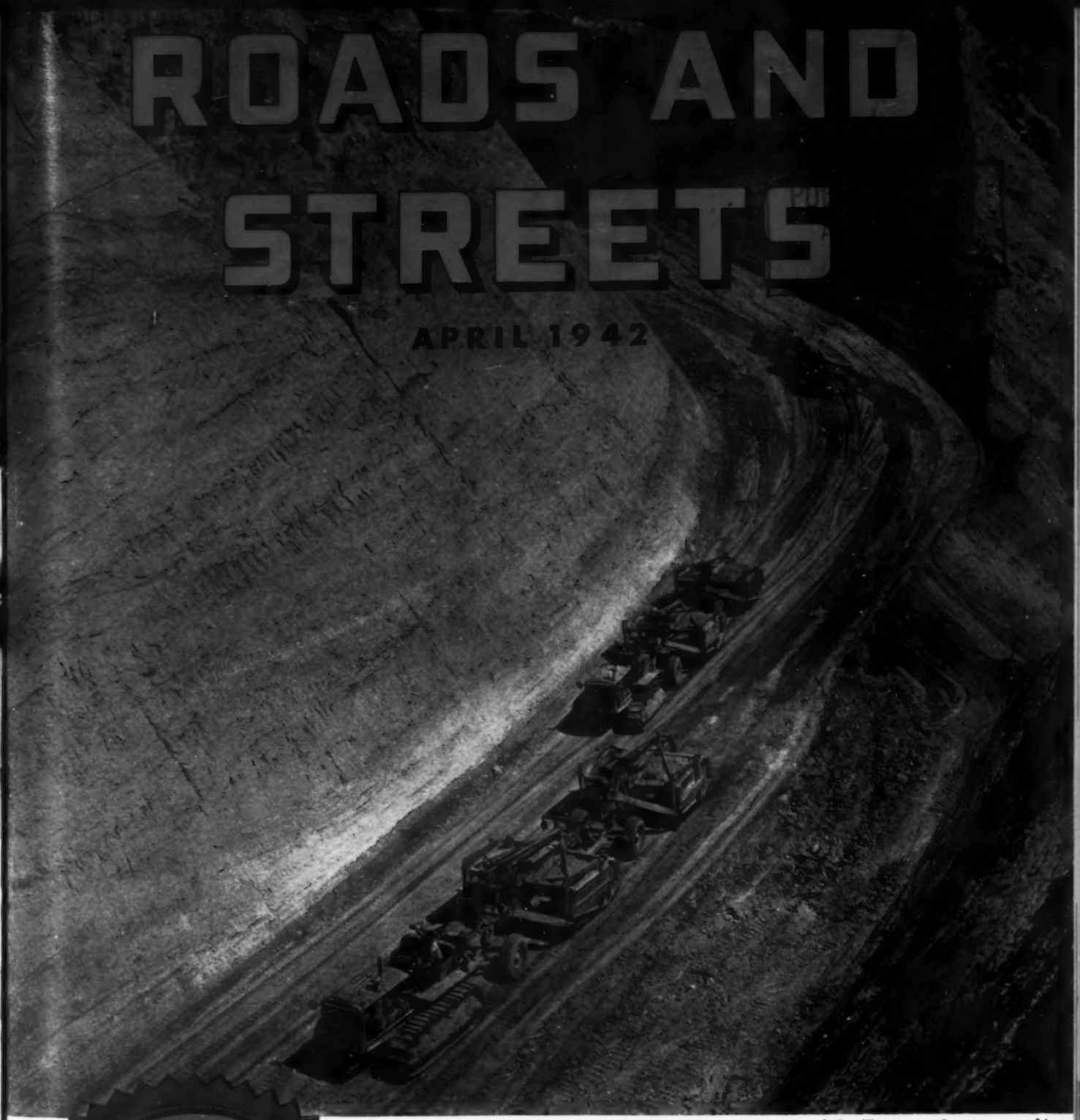


Timken Bearing Equipped "Caterpillar" Tractors and Le Tourneau Scrapers working on the Jackrabbit Trail in Riverside County, California. Crow Bros. contractors.

Timken Bearings are keeping construction's mechanized forces rolling for Victory. After Victory they'll keep 'em rolling for progress.

Make sure the new equipment you buy is thoroughly protected by Timken Tapered Roller Bearings at all points of friction and hard service. Then you can go ahead and *keep* ahead —now and during the severe competitive conditions that may follow the war.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN

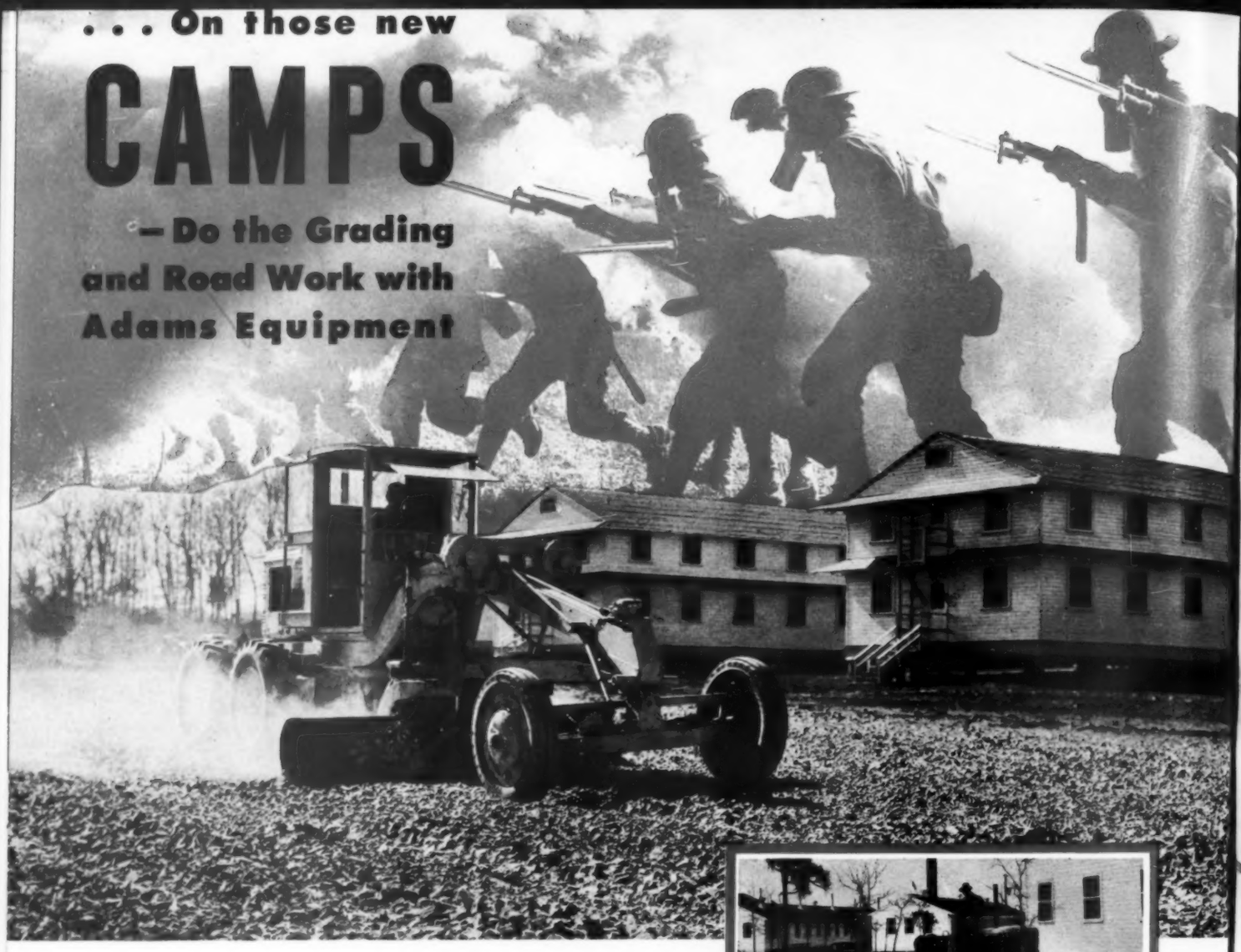
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

. . . On those new

CAMPS

—Do the Grading and Road Work with Adams Equipment



THE VARIETY of grading jobs incident to building or enlarging army camps is "right down the alley" of Adams equipment. For the leveling of building sites, and grounds generally, there are Adams Hauling Scrapers, available in several sizes, which do a "swell" job quickly and economically . . . For general grading, building roads and ditches, spreading or mixing material for parking areas, etc., there are several sizes of Adams Motor Graders which handle such jobs to perfection . . . Not only is Adams equipment practical and economical but it is dependable for "round the clock" performance.

Of course, camps constitute only one type of war projects on which hundreds of Adams machines are being used successfully. Whatever your grading or earth-moving problems, see your local Adams dealer now for needed equipment—he can be of valuable service to you.

J. D. ADAMS COMPANY, INDIANAPOLIS, INDIANA

Sales and Service Throughout the World

ABOVE: An Adams Diesel Motor Grader finishing parking area at a Kentucky camp and similar machine grading around buildings at a new Georgia camp. **BELOW:** An Adams Hauling Scraper leveling building sites at an Indiana camp.

USE THESE ADAMS MACHINES—Motor Graders in six models, Leaning Wheel Graders, Elevating Graders, Hauling Scrapers, Tamping Rollers, etc.

ON THESE DEFENSE JOBS—Airfields, camps, defense building sites, ammunition dumps, access roads, etc.

ADAMS

ROAD-BUILDING AND EARTH-MOVING EQUIPMENT

BETHLEHEM SAFETY-BEAM GUARD RAIL

Our national highway network is one of the vital parts of a compact, hard-hitting war effort. Safe highways cut down accidents, speed up troop movements, help get many thousands of different war materials to their destination on time.

Safety-Beam Guard Rail is obviously only one element in this picture. The roads themselves are naturally the main thing.

However, Safety-Beam Guard Rail can do a real job here. Safety-Beam is one of the strongest, safest guard railings on the market. It makes drivers (whether they drive truck, pleasure car, or bus) feel safer on dangerous grades, curves or hills. Drivers do not tend to crowd the center line, and the hazard of side-swiping is reduced.

Furthermore, Safety-Beam is wide and easy to see, either at night or in the daytime. This highly-visible wall of steel along the highway helps to mark curves and dangerous zones.

Finally, if a vehicle does get out of control and strikes Safety-Beam, it does not plunge through. The shock of impact is soaked up by half a dozen posts at once and the machine is re-directed parallel to the railing.

Safety-Beam can help our war effort by cutting down the number of accidents, and by making those accidents that do happen, less serious. Next time you need guard railing, get Safety-Beam.

Write to Bethlehem Steel Company, Bethlehem, Pa., for bulletin giving full details on this better guard railing.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

ROADS AND STREETS

Vol. 85, No. 4 • April, 1942

CONTENTS

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ROADS AND STREETS

CCA

A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; and to the construction and maintenance of airports.

WITH ROADS AND STREETS HAVE BEEN COMBINED GOOD ROADS MAGAZINE AND ENGINEERING & CONTRACTING

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ESTABLISHED 1906

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Keep these signs off your roads... with LINCOLN-ITE

AFTER FIVE YEARS—STILL NON-SKID! This Lincoln-Ite road has been down five years. Notice how the fine, hard skid-resisting surface has renewed itself. No glazing. Road surface as skid-resistant as when laid.

READ HOW YOU CAN GET CONTINUOUSLY-RENEWING NON-SKID SURFACES WITH LINCOLN-ITE

"Slippery when wet" signs are disappearing . . . not only from primary roads but from low-cost secondary roads. For more and more highway engineers and road commissioners are turning to Lincoln-Ite for maximum economical, long-lasting roads with maximum skid resistance.

They're discovering how Lincoln-Ite's dense graded aggregate design means harder, more enduring abrasive projections, protected against quick shearing by Lincoln-Ite's firm but resilient grip. They're also discovering how this pulverized dry petroleum asphalt gives controlled consistency, void control, that insures continuous *renewal* of non-skid surfaces.

Get the facts. Learn how Lincoln-Ite enables you to use local materials and equipment, save on first cost, cut maintenance costs. Write, today.

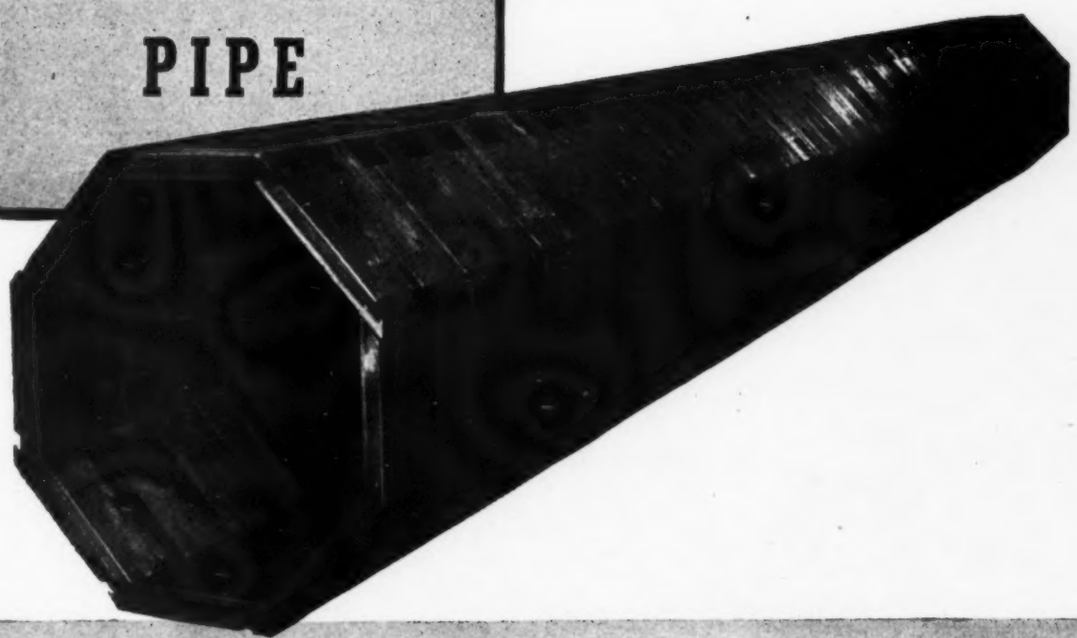
COUNT THE ADVANTAGES LINCOLN-ITE GIVES YOU

1. Greater uniformity—controlled mix.
2. Utilizes local aggregate and equipment.
3. Self-renewing non-skid surfaces.
4. Greater stability and durability.
5. Adapts itself to base movements.
6. Lower maintenance cost.
7. Can be used for lowest-cost to highest-type construction.
8. Tested and proved.

LINCOLN-ITE
PULVERIZED PETROLEUM ASPHALT

THE OHIO OIL COMPANY, INC.
PRODUCERS OF PETROLEUM
Since 1887
ASPHALT DIVISION, ROBINSON, ILL.

NEW EMERGENCY PIPE



Solves War-Time Drainage Problems

Steel, a critical war material, must not be used in any drainage structure except where engineering integrity demands it. Yet here is a practical war-time substitute. It's the ARMCO Emergency Pipe, designed by a drainage engineering organization with 38 years' experience.

This completely new design in wood drainage structures meets war-time emergency requirements. Steel bands, metal reinforcing or other critical materials are not required. The semi-flexible design provides ample strength to meet engineering standards. Yet this Emergency Pipe is light in weight for easy handling. Installation cost is low. There is no field assembly except joining long sections of any length that can be hauled and handled. Skilled labor is not needed.

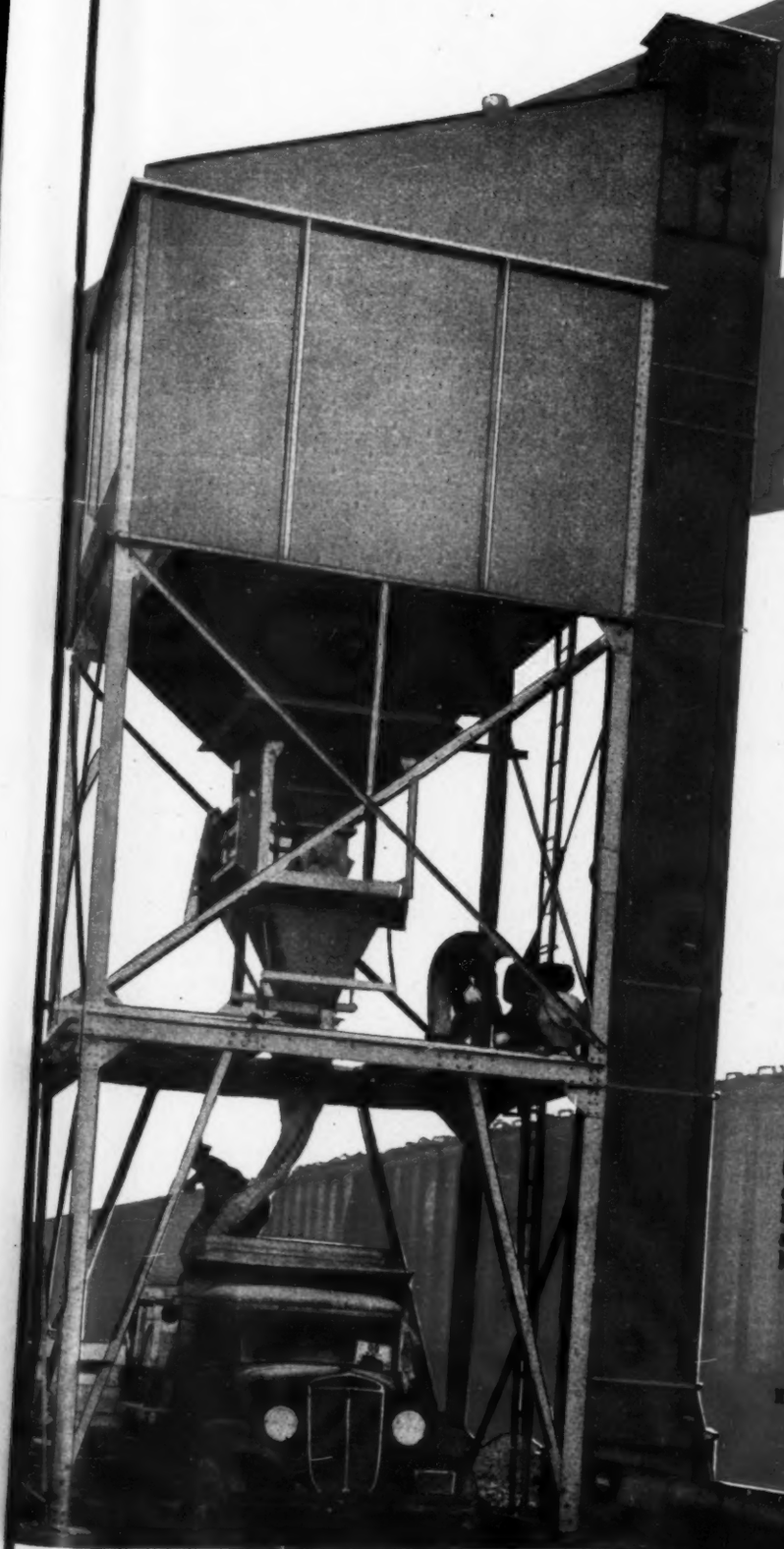
On the durability side ARMCO Emergency Pipe performs admirably as a war-time structure. It goes "all-out" in meeting the War Production Board's requirements for substituting non-critical materials wherever possible.

Use the ARMCO Emergency Pipe for essential culverts, storm sewers, underpasses, conduits or wherever else drainage structures are needed and vital materials must be conserved. Your request will bring complete information. ARMCO DRAINAGE PRODUCTS ASSOCIATION, 425 Curtis St., Middletown, Ohio.

ARMCO 

EMERGENCY PIPE

MECHANICALLY RIGHT!



NO PIT REQUIRED

Elevator rests on ground level.

BLAW-KNOX BULK CEMENT PLANTS

are Trouble Free

Built to keep contractors' jobs running at top speed—you get the best in bulk cement equipment from Blaw-Knox at no extra cost.

Completely portable, leak-proof and weather-proof.

A Blaw-Knox Bulk Cement Plant is ready to go to work when you get it. It's a truly portable, efficient plant which unloads, elevates, stores, accurately weighs, and loads batches of bulk cement into trucks, truck mixers, etc.

The plant comes to you complete. There's nothing else to buy and there are no complicated erection problems.

TROUBLE-FREE because: CEMENT GATE VALVES are made of machined castings, will not leak or jam—WEIGHING SCALES are precision type, [illegible] when batcher is full or empty—BIN SLOPES are steep and smooth for fast flow of cement—BEST QUALITY CONVEYORS and power drives are used. An easy plant to erect, dismantle and transport.

Blaw-Knox Bulk Cement Plants are furnished in any size (100 bbl. to 5000 bbl. or more) and with any number of compartments to accommodate different brands of cement. Either manual or automatic batchers are furnished. They are fully illustrated and described in Blaw-Knox Catalog No. 1566.

BLAW-KNOX DIVISION
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NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM

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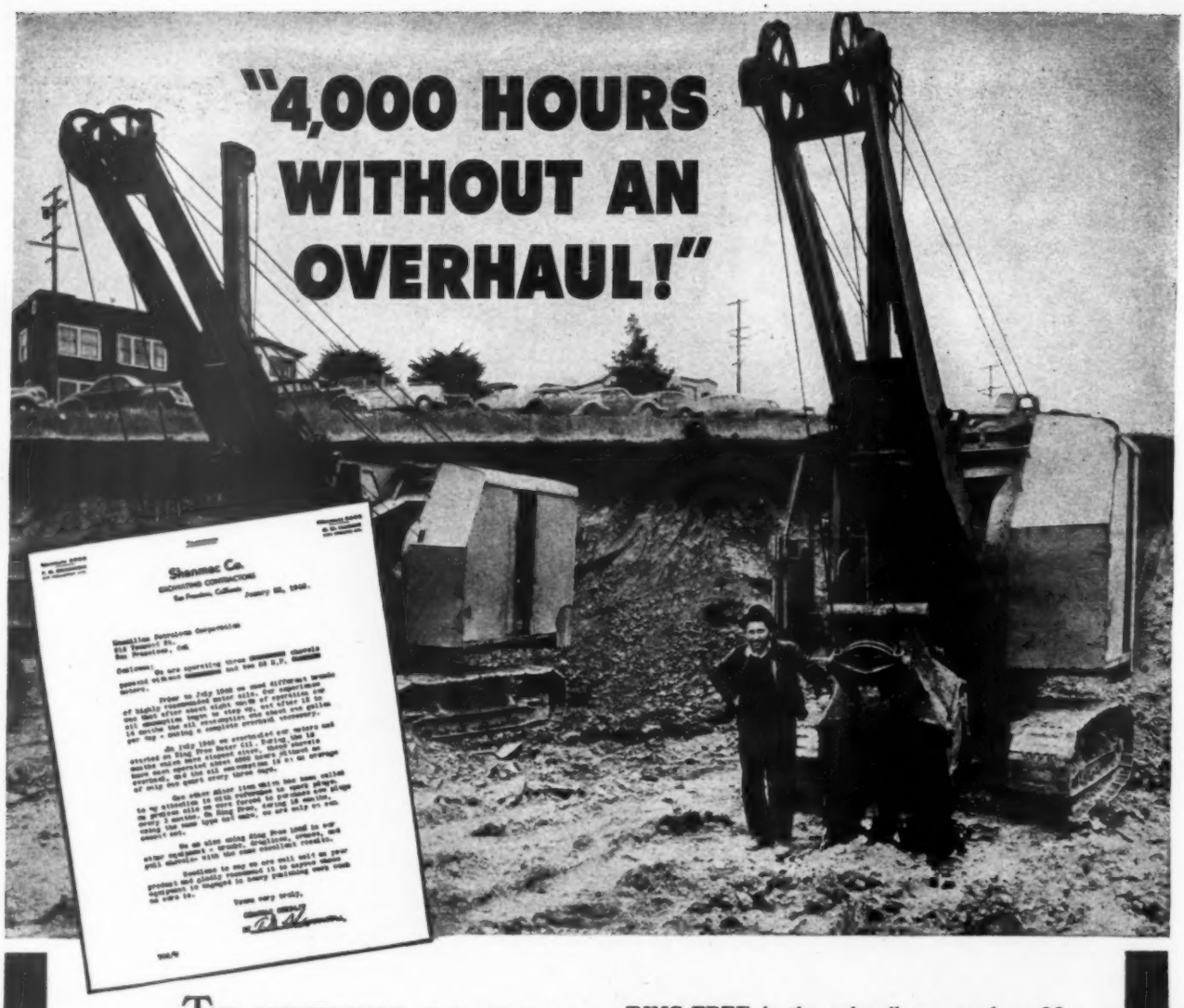


THE EXPERIENCE of the Shanmac Company, excavating contractors of San Francisco was that prior to July 1940 they used different brands of recommended motor oils.

But after about eight months of operation, their oil consumption began to step up. And after 12 to 14 months the oil consumption was about a gallon a day—making a complete overhaul necessary.

"In July 1940 we overhauled our motors and started on RING-FREE Motor Oil," writes T. G. Shannon.

"During the 18 months which have elapsed since, our shovels have each operated about 4,000 hours without an overhaul, and the oil consumption is on an average of only one quart every three days."

On other oils they had to purchase new spark plugs every three months. On RING-FREE, they are on only their second set after 18 months.

"We are using RING-FREE 100% in our other equipment—trucks, draglines, cranes, and pull shovels with the same excellent results. Needless to say we are well sold on your product and gladly recommend it to anyone whose equipment is engaged in heavy, punishing work."

RING-FREE is the only oil you need, as Mr. Shannon points out, for all the different kinds of equipment used by contractors.

What RING-FREE has done for others, it can do for you. Write us!

* * *

MACMILLAN PETROLEUM CORPORATION
50 West 50th Street, New York · 624 So. Michigan Avenue, Chicago · 530 West 6th Street, Los Angeles

MACMILLAN
RING-FREE
MOTOR OIL

THERE is no question about the economy of Bucket Loaders. For twenty years they have loaded material cheaper than any other method or machine.

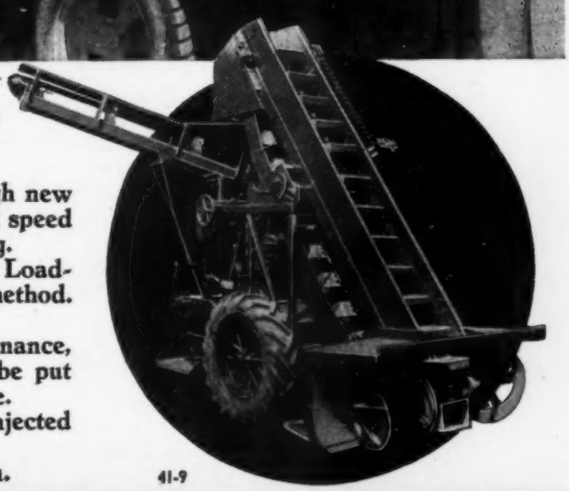
Now the B-G Model 522 offers a new economy through new portability. Not just greater ease in maneuvering—but truck speed towing—with quick and easy hitching—with no dismantling.

This new portability greatly increases the scope that the Loader can cover. It practically obsoletes every other loading method. It makes every other means too expensive.

Simpler systems are now feasible. In highway maintenance, for instance, small roadside stockpiles at the job site can be put down in advance, loaded as needed with the Barber-Greene.

In addition to this new portability, Barber-Greene has injected many other new features into this ingenious design.

Write for complete information. There is no obligation.



41-9

BARBER GREENE

STANDARDIZED MATERIAL HANDLING MACHINES

AURORA ILLINOIS

THE ROAD TO TOKYO WILL BE "HARD GOING", TOO

...but we'll get through

The thousands of Marmon-Herrington "Heavy Duty" *All-Wheel-Drive* trucks and converted Fords in the armed forces of America and her Allies are accustomed to "hard going." They won't fail in the jobs ahead of them, no matter how difficult the terrain may be, for they have been *proved* in the most exacting civilian and military services for years before we actually went to war. Building and maintaining roads regardless of weather, clearing snow from the highways, transporting oil equipment across desert sands, in these and scores of other "worst jobs" they have established records of performance that will put them in the forefront of demand, again, when this war is won. Write or wire for literature. Cable address MARTON.

MARMON-HERRINGTON COMPANY, INC., Indianapolis, Ind., U.S.A.

No mud or snow too deep for the fleet of seven Marmon-Herrington *All-Wheel-Drive* converted Fords in Ionia County, Michigan.

MARMON-HERRINGTON *All-Wheel-Drive*

PIONEER
Foto Facts
No. 15

To produce good gravel, E. P. Brady knew he would have to reject excess sand which cuts down the output of any plant. He also knew he needed big production for profitable operation.

QUANTITY PRODUCTION · QUALITY PRODUCTS

E. P. BRADY
825 DICKENSON STREET
FLINT, MICHIGAN

Pioneer Engineering Works,
Minneapolis, Minnesota.
Gentlemen:

It is now about three and one-half months since we received our new Pioneer 48-V Duplex crushing and screening plant, and we have operated it almost continuously through our Michigan winter. There have been a number of days when it has been considerably below zero, and we have produced gravel from wet pits as well as from dry ones.

Inasmuch as we have been making a very good grade of gravel most of the time, it has been necessary to reject sand. There have been times when we have had to take out almost as much sand on one side of the machine as we were getting gravel on the other side, and we were still able to produce gravel at the rate of 140 yards per hour, which we think is very good production!

I wish to take this opportunity to tell you that the performance of this plant is certainly all that could be desired of a portable plant.

We are also finding that the Caterpillar power unit is very economical to operate and our production costs are exceedingly low - - - even lower than our fondest hopes.

We find that this plant moves very easily considering the weight, and even though we have moved it over some very hilly country through our winter months, we have yet to experience any difficulty.

With kindest personal regards, and wishing you continued success, I am

Very truly yours,
E. P. Brady

E. P. Brady solved his problem with a Pioneer 48-V Crushing, Screening and Loading Plant . . . and read what he says about the results.

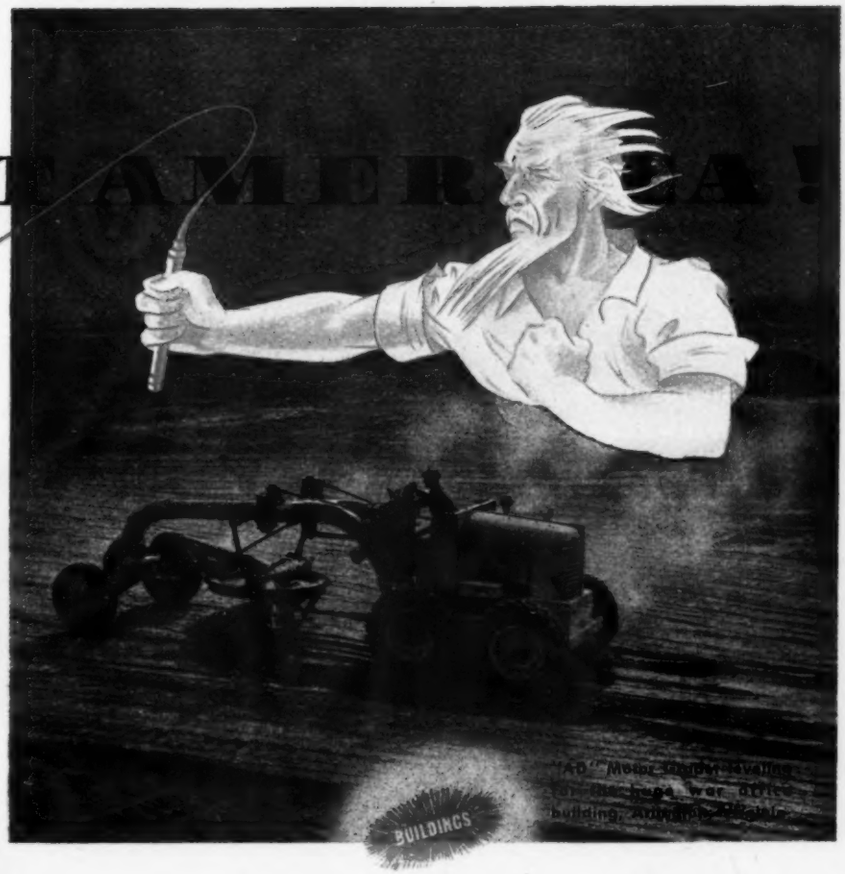
"—TAKE OUT ALMOST AS MUCH SAND ON ONE SIDE OF THE MACHINE AS WE ARE GETTING GRAVEL ON THE OTHER SIDE, AND WE WERE STILL ABLE TO PRODUCE GRAVEL AT THE RATE OF 140 YARDS PER HOUR, WHICH WE THINK IS VERY GOOD PRODUCTION."

The 48-V Plant is the largest of five sizes of Duplex Gravel Plants. They will all produce crushed gravel, reject sand and produce stone chips.

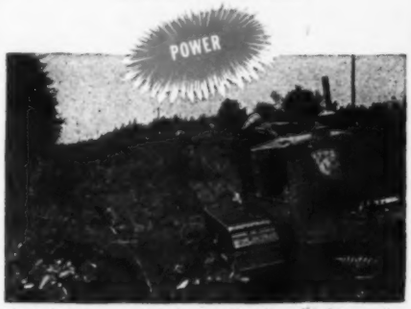
Send for your free copy of our handy reference — "FACTS AND FIGURES"

PIONEER ENGINEERING WORKS
1515 Central Ave., Minneapolis, Minnesota, U. S. A.

GO TO IT AMERICA!



A big gun is hurriedly moved by a powerful 2-cycle Diesel tractor.



Model M. gas tractor, stringing high tension cable in Washington.

Model HD-7, 2-cycle Diesel tractor 'dozing a road through an army camp in North Carolina.

..and don't spare the whip

Back of America's vast striking power are the countless huge plants that produce the tanks, guns, ships, planes and supplies of all kinds . . . the immense network of power lines that keep them going at full production . . . the thousands of miles of strategic roads that quickly move men and materials. A tremendous task . . . laying the groundwork for these lifelines of freedom! But a job that must be done . . . and is being done . . . fast! More than doing their part . . . on the big, important, time-limit projects . . . are Allis-Chalmers machines of all types. Wherever things are moving fast and the word is "go to it . . . get it done" . . . you'll find them—find them breaking records . . . find them making dirt-moving history . . . and doing it without babying or pampering.

ALLIS-CHALMERS
TRACTOR DIVISION · MILWAUKEE · U. S. A.

Power for Victory

INVEST IN THE FUTURE OF AMERICA . . BUY DEFENSE BONDS AND STAMPS

Model M and Hough Shovel used by army engineers on road construction.

Model HD-14 pulling, HD-10 pushing, on 2,000,000 yd. airport job in Alabama.

Model M refueling a plane at Malta.

Pave and Patch with Speed!

Up to 40 tons bituminous mix per hr.

Asphaltic paving materials that meet all specs.

From pit-to-pit or job to job at truck speed.

Set up ready-to-go in 15 min.

Light, compact—yet rugged.

Users report fast production of quality SC-3, MC-2 and RC-4 mixes.

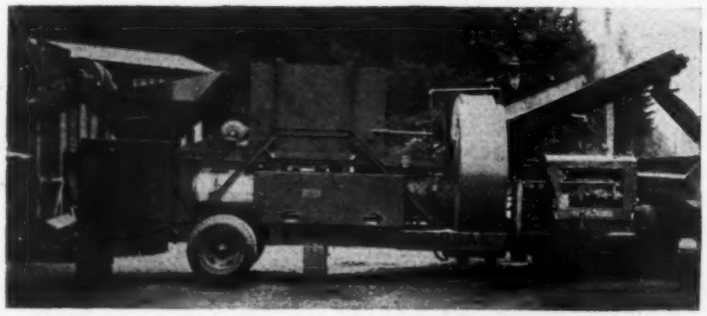
A UNIVERSAL "*TWIN DRYER*" PORTABLE ASPHALT MIXING PLANT

is "Keeping 'Em Rolling" around Helena, Montana. Secondary roads and streets are being surfaced with 2½" of dense-graded plant mixed bituminous macadam by Lewis and Clark County. Specifications call for 60 to 70% fines, to produce denser mixes, and SC-3 oil.

For speed and economy on small contracts, maintenance and patching jobs put a "Twin Dryer" to work—"hypes" up distribution, so vital to Defense!

UNIVERSAL CRUSHER COMPANY
631 C Avenue West — Cedar Rapids, Iowa

Speed up construction of airport runways and aprons, black and white top and oil mix roads, camp walks and drill grounds with Spreaderollers. See proof of its performance in Bulletin 800-A.



"Twin Dryer" at right is producing asphalt mix for maintenance of roads and streets around Seattle, Wash. Send for Bulletin No. 57.

UNIVERSAL

CRUSHERS, PULVERIZERS, COMPLETE PLANTS, SPREADEROLLERS, PORTABLE ASPHALT PLANTS

DON'T HANDICAP YOUR HORSEPOWER

A motor grader without power on the front wheels is like a draft horse with roller skates on his front feet.

YOU ASKED FOR IT

THE NEW "88-M"

Austin-Western

MIDDLE WEIGHT POWER GRADER

● This new A-W Power Grader embodies every feature of the famous heavy-duty "99-M" needed to provide an outstanding medium weight machine... the extra power of All-Wheel Drive... the greater maneuverability of power-operated All-Wheel Steer ... the speed, economy and efficiency of Precision Side Shift and Controlled Traction.

The unrivaled champion of the middleweight power grader field, the "88-M" has ample blade pressure to handle a wide variety of construction and maintenance jobs with new economy and efficiency. Only a "99-M" can equal its versatility on grading, ditching, scarifying, mixing, and backsloping operations.

Write for the specifications on this newest Austin-Western power grader.

THE AUSTIN-WESTERN ROAD MACHINERY CO., Aurora, Illinois

MOTOR GRADERS • BLADE GRADERS • ELEVATING GRADERS • SCRAPERS • CRUSHING AND SCREENING PLANTS • ROLLERS
ROLL-A-PLANES • MOTOR SWEEPERS • SHOVELS AND CRANES • SCARIFIERS • DUMP CARS • TRAIL CARS

A new runway paved in a week or less with SOIL-CEMENT

Baer Field, built by the Army at Fort Wayne, Ind., has 283,000 sq.yd. of soil-cement, including one complete runway and two runways with center strips of heavy-duty concrete (Ohio Engineering Co., Lorain, Ohio).

16,200 sq. yd. daily at U. S. Flying School Airport No. 1, Macon, Ga., with 3 crews (McDougall Const. Co.; W. L. Cobb Const. Co.; W. F. Scott Const. Co.)

●

19,333 sq. yd. processed in 29-hour period at the Hatboro, Pa., Airport. 102,300 sq. yd. of runways and taxiways in equivalent of eight 24-hour working days (D. W. Winkelman).

●

16,241 sq. yd. peak day, 86,000 sq.yd. in 11 processing days with one large outfit at Windsor Locks, Conn., Airport (D. W. Winkelman).

●

18,875 sq. yd. in single day of 19 hours with one double crew at U. S. Flying School Airport No. 6, Albany, Ga., 12-14,000 yards on many days (Hardaway Contracting Co.).

Fifteen to 20,000 square yards a day . . . a mile of runway a week . . . a 500,000 square yard airport paving job completed in 30 processing days . . . such speeds are not only possible, *they're being accomplished* with soil-cement.

But soil-cement offers vital advantages other than speed:

Soil-cement field and laboratory control methods *assure* pavement of all-weather serviceability.

Soil-cement is about 90% soil and therefore saves on material haulage.

Soil-cement is easily placed with simple equipment and ordinary labor.

Soil-cement saves on first cost and maintenance.

Eight million square yards of soil-cement is in service or being built at the nation's airports. Soil-cement is ideal for light-traffic roads and streets, auxiliary and secondary runways; plane parking areas and taxiways; parking areas for army trucks and war workers' cars; road shoulders and widening.

Call on our engineers for design and construction assistance on your soil-cement projects. Write for *"Soil-Cement Construction Details,"* mailed free in the U. S. or Canada.

PORTLAND CEMENT ASSOCIATION, Dept. 4-28, 33 W. Grand Ave., Chicago, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

SUPPORT THE RED CROSS . . . BUY DEFENSE STAMPS AND BONDS

These Men KNOW INTERNATIONAL Industrial Power

THE MAN WHO SELLS IT

and the MAN WHO SERVICES IT

INDUSTRIAL POWER INTERNATIONAL SERVICE

Let Them Help You Keep Your Equipment ON THE JOB

To GET maximum efficiency from International Industrial Power during the busy days ahead, give it the best of care. Make use of *the men who know this equipment best*. They are *the men who sell it* and *the men who service it*. They are the International Industrial Power dealers and their servicemen from coast to coast.

Through up-to-date, Company-issued service manuals and bulletins and through contacts with Company servicemen, the International dealer's service department is continually kept informed of the best methods and practices for servicing International TracTracTors, Wheel Tractors, and Power Units. You get the benefit of this information when you bring in your equipment for servicing. It can save you many a dollar, many a delay, in expert, reasonably-priced preventive maintenance and overhaul.

The user, dealer, and serviceman all benefit by International Harvester's background of quality manufacture, engineering, and metallurgical experience. International Industrial Power is made for the toughest going. International Service *keeps it working*. Your tractors and power units have *a big job to do* in America's March to Victory. Keep them *serving well* by keeping them *well serviced*.

INTERNATIONAL HARVESTER COMPANY
Chicago, Illinois
180 North Michigan Avenue

Time-Saving, Money-Saving INTERNATIONAL TracTracTor Service Helps

CARE, OPERATION, ADJUSTMENT

Fuel, Oil—Store in clean, covered containers.

Air, Fuel Cleaners—Clean them regularly.

Tracks—Adjust slack and tension for best work.

Nuts, Bolts—Go over them frequently; keep them tightened.

Oil Screens—Clean regularly; replace filter element as instructed in operator's manual.

Steering Clutch Levers, Steering Brake Pedals—Adjust to suit operator.

Read, study your operator's manual for other money-saving suggestions.

MAINTENANCE

Unit Replacement—Saves time.

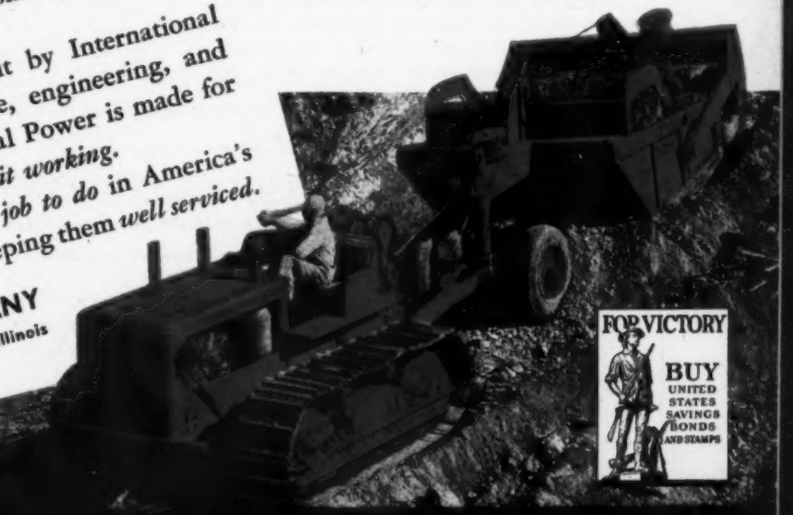
Sleeves, Pistons—Replace when needed—quickly, easily.

Crankshaft Bearings—Replace when needed; no fitting or reaming necessary.

Transmission—Inspect and adjust regularly.

Transmission Bearings—Replace when wear occurs (this eliminates other expensive replacements).

Steering Clutches, Brakes—Inspect and adjust regularly; replace as needed. Clutches and brakes can be removed without disturbing bevel gears, sprocket drive gears and shafts, track frames, or track rollers. Adjustment of either clutches or brakes can be done independently of the other.



INTERNATIONAL Industrial Power

A New COST DATA BOOK

ROAD AND STREET CONSTRUCTION METHODS AND COSTS

BY

HALBERT P. GILLETTE

AND

JOHN C. BLACK

This book was planned and compiled expressly for use by contractors, engineers and highway officials.

It is not a textbook, but is a compendium of data carefully selected with reference to their usability by highway builders and other persons concerned with highway construction costs.

In general the data are of two main classes—dollar and cents costs per mile, per square yard, per cubic yard, and the like, for use in quick approximate estimates; and details of material, labor and equipment costs, with records of man-hours and machine-hours, for use in close estimating and in studies to reduce costs or improve methods.

The data are from a great number of different sources, and are in widely varying detail.

All major articles carry descriptions to show clearly the class of work and the methods for which costs are given, and to provide a basis for further reference and study if desired.

Location and date of job and the source of information are given in the title and introduction to each article.

The grouping of subjects in chapters is convenient, but an unusually complete index is furnished as the main guide to any subject or sub-subject sought.

The authors are both men of practical experience in highway and other construction. Both are members of the American Society of Civil Engineers.

The book is filled with useful data, and its answer to just one question may easily be worth hundreds of times its price.

608 pages—hard cloth binding—price $6.00

Sent, if desired, with 10 days approval period.

GILLETTE PUBLISHING COMPANY

330 SOUTH WELLS ST., CHICAGO, ILLINOIS

GILLETTE PUBLISHING CO.
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OUTLINE OF CONTENTS

CHAP. 1. INTRODUCTION — Brief discussion of construction costs, prices, profits, etc.

CHAP. 2. COST INDEXES—Important indexes—their uses and limitations.

CHAP. 3. OVERHEAD COSTS—Contractors' overheads and public overheads compared.

CHAP. 4. ENGINEERING — Data from states, cities and other sources.

CHAP. 5. RIGHT-OF-WAY—Records and discussions.

CHAP. 6. EQUIPMENT — Rental, ownership and expense schedules in full detail; followed by records of operating and maintenance costs.

CHAP. 7. LABOR — Schedules, records and comparisons of wage rates, etc.

CHAP. 8. CLEARING AND GRUBBING — Records of work by various methods.

CHAP. 9. GRADING — Records and analyses of operations with varied types of machines under various conditions.

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CHAP. 18. WALLS, FENCES AND GUARD RAILS—A short chapter of data.

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CHECK PAGE 53

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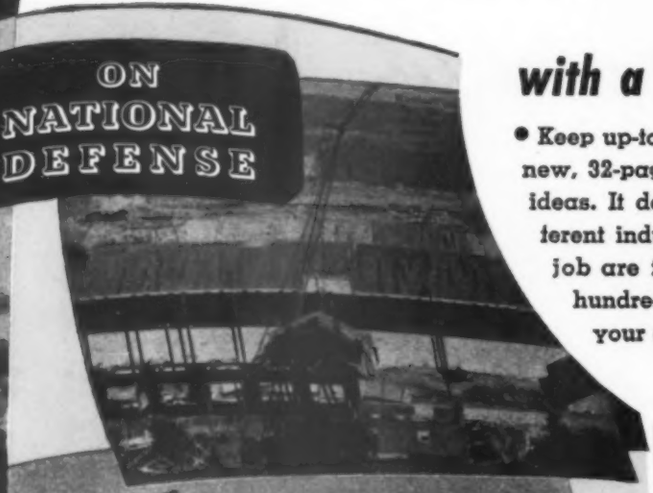

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ROADS AND STREETS

April, 1942, Vol. 85, No. 4

Contractor Invades Territory of General Mud

Forms and Construction Procedure for Grade Separation Project Designed by Contractor

By P. F. GLENDENING

Resident Engineer
Arizona Highway Department

SEPARATION of highway traffic from a railroad grade crossing and an intersecting highway grade crossing created an extensive structure and approach construction in Arizona on U. S. 80, which carried the State Route 86 under the Southern Pacific Railroad and U. S. 80. The Benson underpass, as the structures and approach highways project is known locally, is outstanding because it is the largest of such type of project constructed in Arizona, and because of the gunite construction of the cut slopes to the underpass portals. Another feature of the job was the saturated clay substrata encountered.

General Description

The Benson underpass and approach highways project is located at the eastern town limits of Benson, Arizona. The project was designed to facilitate traffic on the two highways and to pass State Route 86 under the Southern Pacific Railroad. The design is such that traffic going from Benson east on U. S. 80 keeps to the right; traffic coming into Benson from the east on U. S. 80 crosses State Route 86 via an overpass. East and west bound traffic on State Route 86 goes through the underpass and under the overpass. The various roads were designed for automatic speed control with super-elevation designed to slow traffic as it entered Benson.

The underpass structure is of modern rigid frame design with hinged footings on the outer walls and fixed footings on the center walls. It provides two lanes of traffic in each barrel and has a sidewalk in the south barrel. It is self draining in an easterly direction toward the San Pedro River, the approach ramp falling away from the structure. All of the footings are set into a dense red clay stratum which underlays the area. The overpass structure is designed as a rigid frame with free ends at the abutments. All pier footings are set into the clay stratum with the higher abutments being carried on steel H-piles, driven into the clay to a sufficient depth to provide the required carrying capacity.

The cut slopes of the ramps into the underpass as well as the center dividing strips are covered with a 2 in. gunite blanket, reinforced with electric welded mesh.

The pavement throughout is a dense graded asphaltic plant mixed type with SC-6 for the binding agent. A seal coat of emulsified asphalt and chat was applied over the oil cake to provide a non-skid, light colored surface. Both portal approaches of the underpass are lighted with sodium vapor lights and the interior with fluorescent lights set flush with the ceiling. In order to improve the lighting characteristics and to prevent the walls from being used as practice areas by young artists and poets, a one-half inch coat of white cement gunite with "Gun" finish was applied to all walls visible from the roadway. This produced a rough pebble-dash finish, pleasing in appearance, which has proven a cure for the usual problem of cleaning writing and pictures from the walls.

Fig. 1.—Mud condition encountered throughout the construction area well shown by this picture

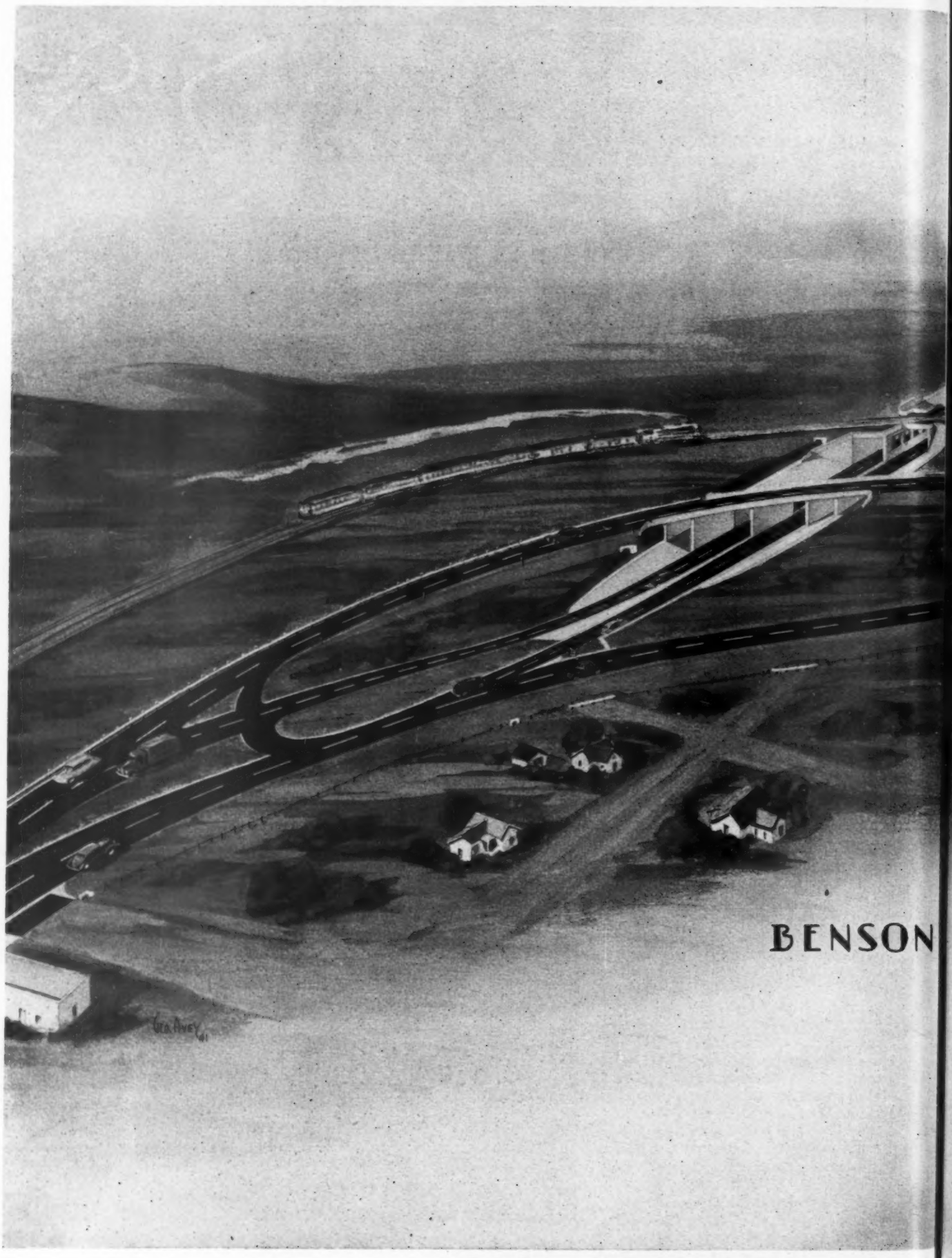
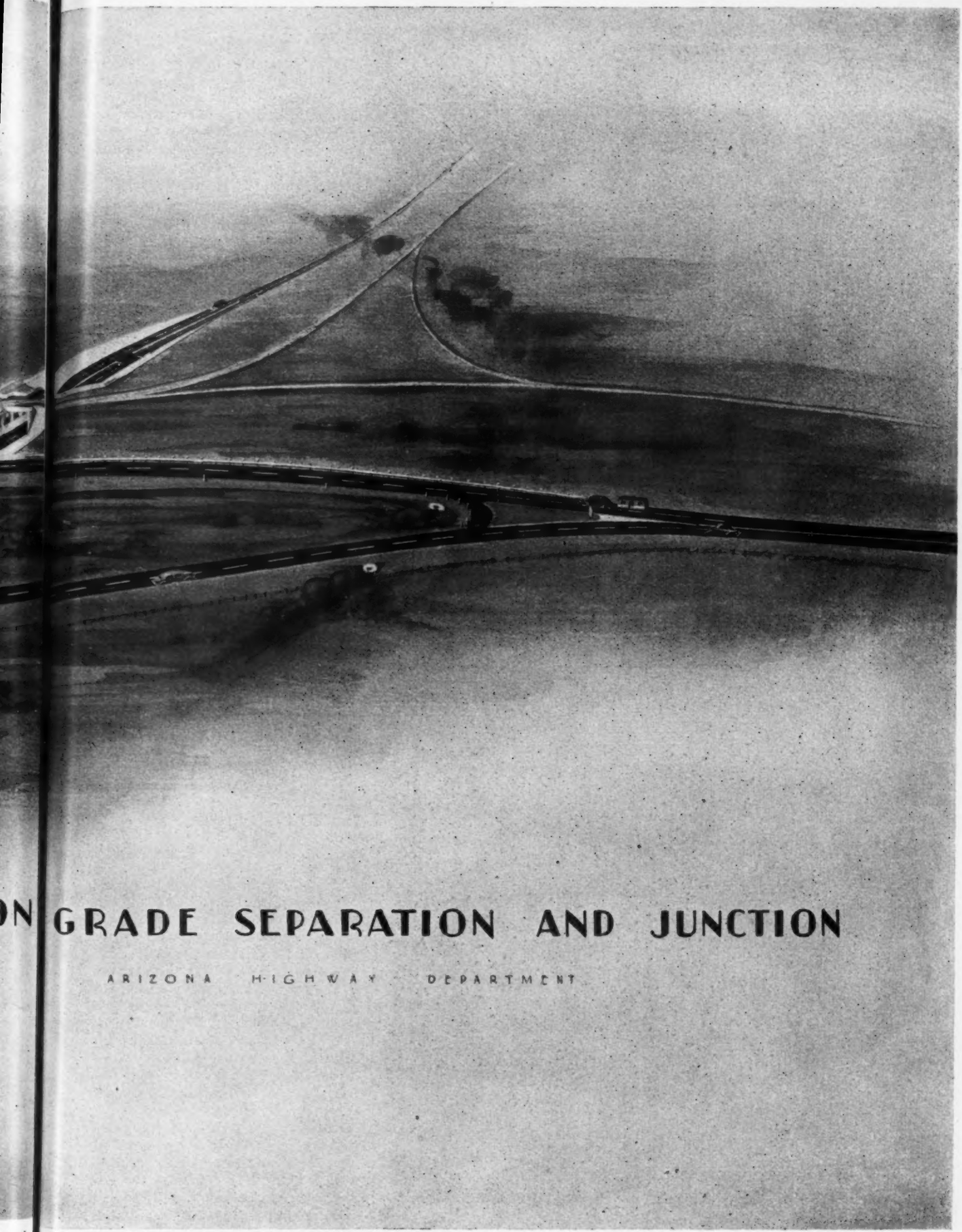


Fig. 2.—Engineers preliminary drawing of Benson highway and railroad grade separatio



paration project showing included roadway approaches and scheme for routing traffic

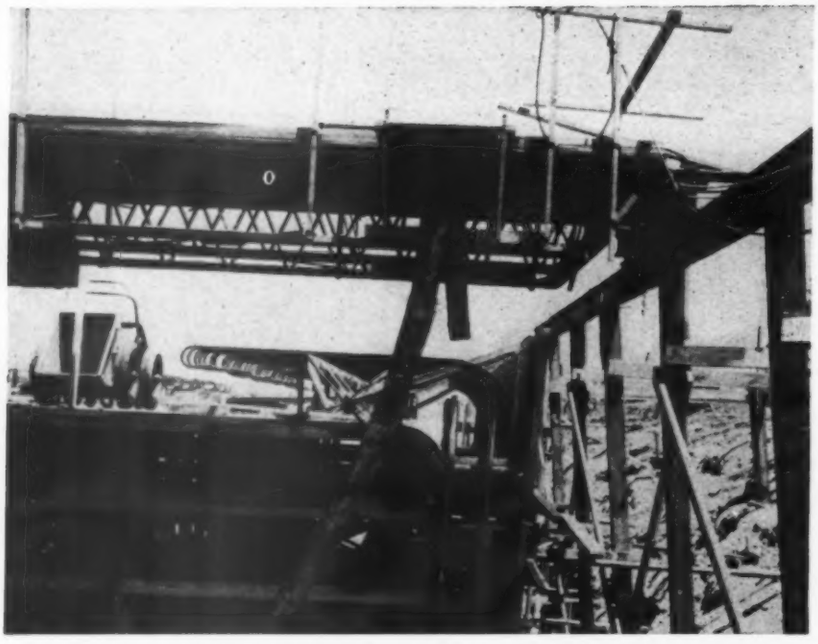


Fig. 3.—Pouring-truss with supporting track and trestle shown in detail. The formwork of the underpass barrel shows the batter on the walls used in the rigid frame design as well as the heavy corner reinforcing steel. Note neatness of contractors formwork and designed trestle

Construction Difficulties

Before the excavation for the underpass could begin, the contractor constructed a shoofly embankment for the railroad, which served until the tracks could be placed over the structure. On completion of the underpass the railroad company removed all tracks to their permanent location over the structure and the balance of the project construction was executed without interference with the railroad. The railroad work on the project was extensive requiring a complete rearrangement of a great many of the facilities in the Benson yard. A new "Y" track was constructed which allowed the elimination of a grade crossing about a half mile east of the underpass on U. S. 80.

As it was known that some water was ponded in the area, provision was made in the contract to begin the excavation at the easterly or lower end of the project with the hope that the moisture would drain from the material in the west end of the project. However, it was found that the material in the west approach to the underpass was just as wet or wetter than the material in the east area.

The contractor removed a great deal of the excavation on the east end of the project with Tournapull equipment. However, as the excavation progressed, so much mud was encountered that considerable difficulty was had in moving the material with the heaviest type crawler tractors and scrapers. In some cases, three crawler tractors were used to move one Le Tourneau scraper. The entire underpass area was found to have a layer of mud extending from a few feet under the surface to the dense clay stratum. This was caused

Fig. 5.—Concrete pads were built to support shoring of formwork as shown in this half-view of the underpass. Truss work at top is part of contractor's moveable pouring bridge

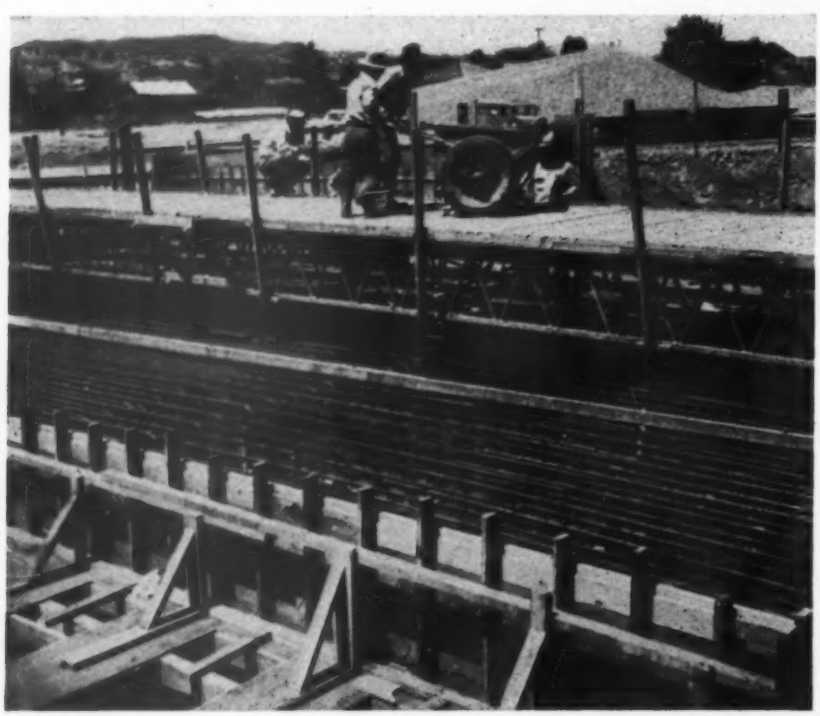


Fig. 4.—Typical concrete pouring operation showing buggy on moveable bridge. Steel arrangement is typical of decks. Again note neat form design and framing

by the clay stratum being higher at the east end of the area than at the west end and the natural drainage being toward the east. Surface water and water from railroad water columns had collected for years in the area. This was aggravated by an artesian well which had been drilled years ago by the railroad company and whose casing was so badly rusted as to be leaking under the surface. It was necessary to remove all of the mud throughout the roadway section as much as *six feet* below grade and to replace it with selected material. The old artesian well was repaired by excavating down about 25 feet below roadway grade, driving a new casing and backfilling with stable clay compacted with air hammers. A concrete seal was placed over the excavated area and provision made to drain any water which seeped past the seal. Sub

drains were placed so as to drain water from the lowest excavation level to prevent any future trouble from ponded water. The clay stratum encountered is very dense and dry, having been penetrated only an inch or so by the ponded water. As all of the footings are set into this material, no trouble should be had in the future from settlement of footings.

Practically every foot of roadway, curb, gutter, and gunite slopes throughout the project is on a curve, vertical, horizontal or both. Curves were also used in designing the overpass structure. In this structure, the piers were all on curves, none of which is parallel to another and none of which is of the same degree. The deck and hand rail is also on a curve, part of which is a spiral. The overpass is also highly superelevated. These curves coupled with varying superelevations, grades, etc., were responsible for many headaches to contractor's men and engineers alike.

Fig. 6.—Looking down into wall form showing arrangement of wall steel

Materials Supply

A good deposit of gravel was located by the State on top of a hill a few miles east of Benson. The contractor extracted all concrete aggregate as well as material for pavement from this pit. The sand from the pit was dirty and was washed at the underpass sight with a washer built by the contractor. The State had a well equipped field laboratory at the field office in Benson in which all material was tested day by day as it was produced. Typical samples were sent to the Highway Department Laboratory in Phoenix for checking. Concrete mixtures were designed in the field to have a two to two and one-half inch slump with correction for moisture and grading being made when necessary. An attempt was made in designing the mixes to attain the required twenty-eight day strength in seven days. This was possible in practically all cases and speeded the work considerably.

Fig. 7.—Mixer and batcher plant setup. Truss of pouring bridge shown at left

Concreting Procedure

The contractor built a steel truss bridge sixty-five feet long and two feet deep, mounted on tracks carried by wood bents, to pour the greater part of the concrete in the underpass structure. This truss was movable from end to end of the structure by means of block and tackle. The mixers were mounted high enough so that the buggies could be wheeled directly from the mixer along a runway parallel to the structure and thus onto the truss without being pushed up grade. The truss was of all welded construction and proved to be very rigid, deflecting only about a quarter of an inch under the load of two concrete buggies. This arrangement for pouring concrete was very satisfactory from every standpoint as it was possible to pour at any place on the structure without any delay by pulling the truss along to where the pour was to be made.

Forms for the underpass and the overpass structure were constructed of ¾-in. plyform sheeting with standard studding and walers spaced at such intervals as to prevent buckling or bulging. Forms were all designed to handle a six-foot vertical pour per hour. Universal Twistie clamps and ties were used throughout with uniformly good results. Shores for the underpass deck forms were set on concrete blocks poured in place. On account of the decks being from two

Fig. 8.—Guniting center dividing strip. Cut bank has already been gunited

Fig. 9.—Looking west toward railroad underpass with U. S. 80 overpass in background

Fig. 10.—Structure carrying U. S. 80 over State Route 86. Note gunited backslopes

to three feet thick, the deck forms were quite heavy. They were, however, designed by regular engineering methods to use the least possible lumber. The design and workmanship on the forms was such that excellent lines were obtained.

The trimming of the slopes in preparation for the guniting was very tedious work as they were on one to one slopes with parabolic curves at the top. An adjustable template was constructed to set the control points, which was very successful.

Quantities and Personnel

The project was broken down into sixty odd items chief of which were 38,000 cu. yds. of excavation, 63,000 tons of imported borrow and select material, 3300 cu. yds. of concrete, 500,000 lb. of reinforcing steel, 9500 lin. ft. of various types of curb and gutter, 4800 tons of plant mix. The total contract cost was in excess of $220,000.

The project was constructed as part of the Federal Aid highway system with the aid of federal funds by the Arizona Highway Department of which W. R. Hutchins is State Engineer. The contract for the construction of the project was held by the Pearson & Dickerson Company of Prescott, Arizona. Railroad work was done on a force account basis by the Southern Pacific Company.

The project was designed by the Division of Bridges and the Division of Plans of the Highway Department under the direction of Ralph Hoffman, Chief, Division of Bridges and Earl Miller, Chief, Division of Plans.

The construction was carried out under the general supervision of Mr. J. R. Van Horn, District Engineer. The writer served as Resident Engineer on the project and was ably assisted by a field force led by C. B. Potts, Chief of Party and R. E. Murray, Inspector.

Motion Pictures as a Public Relations Medium

Motion pictures are being used by the Emmet County Road Commission, Petoskey, Mich., to give the general public a better knowledge of the county roads works. How this public relations work is carried out was described as follows by Walter O. Dow, Engineer-Manager of this Commission at the recent Michigan Highway Conference.

We owned a 16 mm motion picture projector, purchased about a year ago. This machine is owned jointly by the Road Commission and the Emmet County Road Club and is used at monthly meetings of our employees.

We now purchased a Bell & Howell 16 mm magazine type camera. This camera is equipped with a F. 1.5 lense which is fast enough to take colored pictures under adverse conditions. A Weston exposure meter completed our equipment.

Before taking any pictures an outline was prepared of the story we wish to present. This was done so that our pictures would proceed in a logical sequence and not be a confused assembly of isolated "shots."

For our first attempt, we decided to show the story of a black top road tracing the development from the original clearing and grubbing to the finished product.

We divided this construction into five stages and explained that each stage could be used until volume of traffic warranted the next stage. Then if the money was available we would complete the next stage.

The five stages were:

1. Clearing and grubbing.
2. Earth grade construction.
3. Gravel surface and gravel manufacture.
4. Gravel stabilization with clay and calcium chloride.
5. Black top surface. Road mix of tar and gravel.

All our pictures were taken to fit into this outline. Later the individual shots were sorted and spliced into their proper place with titles that we had previously prepared.

The completed film was presented to the Board of Supervisors at their annual meeting. We received much praise from them. They also asked a great many questions which convinced us of their interest.

We have since shown this film at several public gatherings and have received much favorable comment.

We believe this is a good medium for interesting the public in highway work. We are now working on a general maintenance film and one showing ice and snow control.

'Straw Votes' for Victory

By HALBERT P. GILLETTE

SCIENTIFICALLY conducted straw votes have foretold election results with amazing accuracy. Yet they record only the intentions of a few men. Let a "straw vote" record not only mental but mechanical conditions, and its reliability becomes much greater than that of an electoral straw vote. For this reason the ratio of Allied to Axis planes destroyed has a significance far beyond that hitherto attributed to it.

After Dunkirk the Hitler heilers began their devastating air attack on England, but far more significant than the havoc wrought on British buildings was that wrought on German airplanes. From the very beginning it should have been evident to the world that the Germans were bound to lose in the plan to invade England, because the "straw vote" cast by the respective pilots of the combatant forces was more than 3 to 1 against the invaders in nearly every fight. The other day the British published a statement that confirms those early "straw votes." During the entire war they have destroyed about 9000 German planes and have lost about 3000 of their own!

"Votes" in Far East

Let us therefore turn to the Far East and count some of the "straw votes" of the opposing pilots there; for in the ratio there recorded, we shall have a reliable measure of what the final result will be.

In a report from Rangoon, Burma, dated Jan. 28, it is stated that American volunteer flyers, although outnumbered three to one, that day put to rout 37 Japanese planes after shooting down seven of them. This statement is significant, but we have the full significance—its "straw vote" significance—only when we read that the Americans lost only one plane. On the 29th another similar air raid in the same locality was even more disastrous to the Japanese. They lost 13 planes and the Americans lost none. On the 30th the week's score stood at 50 Japanese to two American planes destroyed. This "straw vote" was 25 to 1 against ultimate Japanese victory in the air! These American flyers of Rangoon had downed 111 Japanese planes up to Jan. 30, but the reporter of this fact failed to realize how important it is to state the number of planes lost by the Allies in these encounters, for he did not give the total American planes lost in downing the 111. I doubt whether our strategists give sufficient weight to such figures.

The tendency of reporters at the front has been to attribute outstanding air victories to the superior bravery and skill of the Allied pilots. This has never seemed to me an adequate explanation. Japanese flyers have had four years of war against China in which to acquire skill in handling planes, bombs and machine guns. They showed that skill when their torpedo planes blew up two of Britain's mightiest battleships in one attack near Singapore; and I have read no criticism of their lack of skill in their bombing attack on Pearl Harbor.

Superiority of Planes

In the report of the air fight near Rangoon on Jan. 28, at last an American reporter has indicated that the superiority of the American planes had much to do with the victory. He said the "fragile Japanese army planes" (type 97) were "completely beaten by the faster and heavier Tomahawks whose cockpits are sheathed with armor plate." Superiority of combat planes undoubtedly has had most to do with these Allied air victories in the Far East.

The American redmen of Colonial days and even later were consistent losers against the white men, not because they were less brave or skillful but because they were not so well armed.

The Japanese armada in the Strait of Macassar went up against American Flying Fortresses and the Allied navy with results so disastrous that one-third of their ships were sunk or badly damaged within a week. A word about Flying Fortresses, those 25-ton monsters of the stratosphere when they choose to be stratospheric, or dive bombers when they choose to skim the sea.

In 1937 the first Flying Fortress was delivered by Boeing to our Army. European designers of combat planes ridiculed the construction of combat planes of such size and weight. They predicted their speedy destruction by swarms of smaller, faster fighters. Much as the giant dinosaurs of the Mesozoic Age were defeated by smaller animals in the struggle for existence, it was predicted that the American Flying Fortresses would not survive.

Private Enterprise

The Germans dubbed them "flying targets." So they were. A fort is a target, but heaven help the warship that tries to shoot it to pieces. For months the British have been crying for more Flying Fortresses. They are, in fact, the most important development in fighting mechanism that this World War has yet produced. Please note this very significant fact, they are an American invention, and that they are not the invention of men employed directly by the government. Here again, as always, private enterprise has proven its superiority. Not till Feb. 2 was the first "straw vote" published as to American Flying Fortresses versus Japanese fighter planes. Four American bombers were attacked by a Japanese fleet, and nine of the latter were destroyed to one of the former!

The Japanese are notoriously deficient as inventors. Not a single one of the 374 great inventors of the last 300 years is a Jap! They are therefore an ideal enemy for us!

The "straw votes" prove it.

---

16 States Have No Fixed Speed Limits.—One-third of the 48 states have no fixed speed limits for driving on the open highway.

Over 86,000,000, Motor Vehicles Made in U. S.—In the last 44 years 86,168,000 automobiles, trucks and busses have been built in the United States. The wholesale value is $58,207,000,000. In the 44 years 1,481 different makes of cars have been built.

Reprinted from the *Los Angeles Times* of March 11, 1942.

Saving Critical Materials in Bridge and Highway Construction

By STEWART MITCHELL
Bridge Department, California Division of Highways

BRIDGE engineers, with all other structural engineers, are now forced to use all the ingenuity they possess in order to build new structures using the smallest possible amount of "priority" or critical materials. Many structural materials, the most important one being structural steel, have been designated as requiring a priority before they can be obtained. Nevertheless, the limit to which the engineer should go in substituting shorter lived and less economical materials for those that are hard to get, is not at all definite. There are many factors that complicate the situation such as the supply of raw material, the capacity of existing plants to fabricate any of the many structural shapes in use, the availability of transportation facilities and the coordination of construction schedules. The time factor is, of course, the most difficult to correlate, since it involves the estimating of future requirements which no one, except-

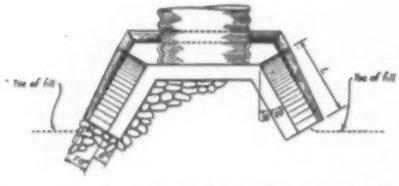


Fig. 1.—Plan of headwall for pipes over 48 inches in diameter

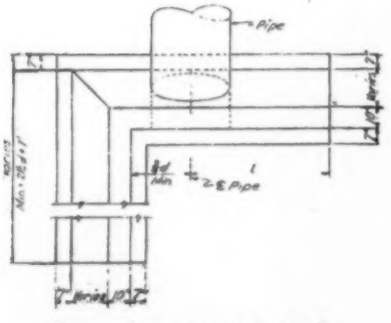


Fig. 2.—Plan of an L-headwall

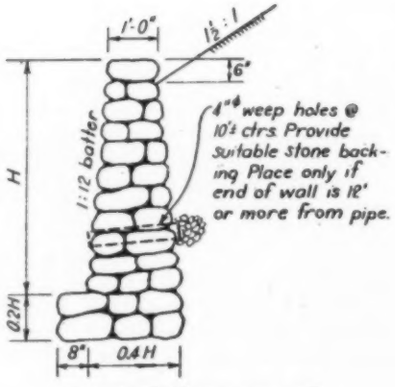


Fig. 3.—Ruble masonry wall

cepting a radio news commentator, dares to do. The line between the necessary and the desirable, or beneficial projects is a vague one and often predicated on what the future will bring about. Who can say definitely how much of a particular kind of plant or machinery should be set up in order to turn out a product the need for which keeps changing as time goes on? The best that can be done is to size up the immediate needs and then proceed in a way that will overcome them in the shortest possible time.

Under such circumstances, it is evident that no one can say definitely that needed critical materials can be obtained at the proper time to fit in with a definite construction schedule, or if they can be obtained at all within the time that can be spared for the completion of a project. Therefore, engineers can only follow a general policy of using non-critical materials wherever it is practicable to do so, and if it is not, of using the minimum amount of priority materials of the more plentiful shapes and sizes. In line with such a policy, existing structures requiring the use of critical materials should only be replaced when they cannot be maintained in a reasonably safe condition and the need for them cannot be served otherwise. As a further corollary, the customary consideration of economic factors which govern the replacement of a structure must be relegated to a position of secondary importance for the time being. Of course, when practically none of the critical materials are needed, the decision to replace a bridge would still be based on the usual economic factors, provided proper consideration is given to present conditions affecting the availability of man-power and equipment, and the possible delays in delivery of materials.

Must Soft Pedal Strict Economy

As a general principle, therefore, when a bridge must be replaced or a new one is necessary, regardless of the priority rating which the project may be given, the engineer should strive to use the minimum amount of critical materials compatible with sound engineering procedure and

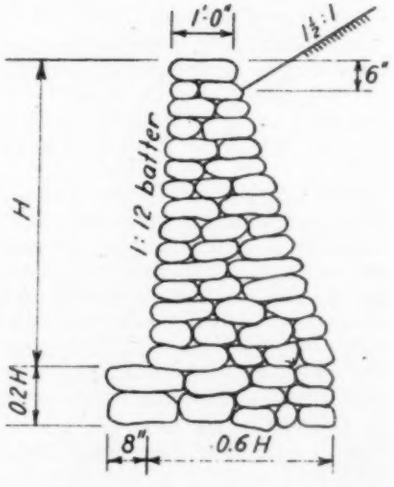


Fig. 4.—Dry rubble wall

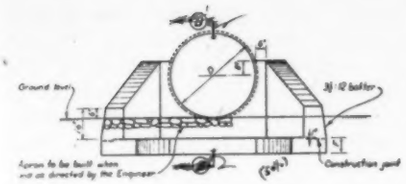


Fig. 5.—Elevation of culvert headwall for large pipe

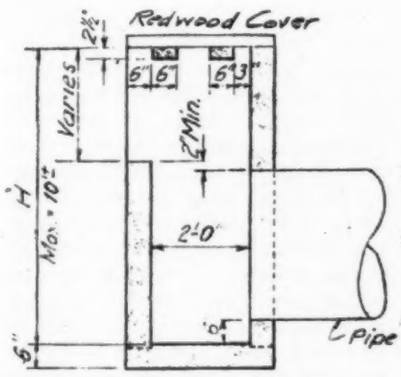


Fig. 6.—Cross section of drop inlet without reinforcing

must soft-pedal the usual consideration of strict economy. With such an idea in mind, the Bridge Department of the California Division of Highways has been designing its current bridge construction work, and revising its standards for small drainage structures, to use a minimum of critical materials. Since steel enters into structural work in many forms, running from nails to large fabricated members, it is impractical to do away with its use entirely. When it is not practicable to avoid the use of reinforcing bars or structural shapes, use can be made of second hand material which, if taken for other purposes, would have to be melted or re-fabricated. In this category are light railroad rails unfit for relaying, and members salvaged from bridges which have been replaced because of weakness or obsolescence. Timber is used wherever possible but care is taken in the design to see that conditions leading toward rapid decay are eliminated. Unreinforced concrete piers and abutments are used, where pile bents are not used, in order to keep the timber away from contact with the ground. When piling is necessary, it has been possible, so far, to obtain pressure treated fir or pine piles, and in some cases, steel shells for cast-in-place concrete piles. If untreated timber must be used, consideration is given to convenient methods of replacing it with more permanent materials sometime in the future. In the case of small drainage structures, the use of steel, and also of untreated timber in contact with the ground, can be avoided by the use of unreinforced arch sections to be built of either rubble masonry or concrete. Figures 1 to 11, inclusive, show designs for small drainage structures including culverts, headwalls and drop inlets.

Substituting Materials

Several types of longer span structures, for which no priority rating can be obtained at this time, and whose construction cannot be postponed, furnish interesting design problems. Of course, the use of an old steel truss — repaired, strengthened, widened or shortened as needed—is nothing new, and the practice is being continued when practicable. However, the alteration of old structures to fit modern conditions nearly always requires additional structural steel and a considerable amount of fabrication that cannot be done in the field. Under present conditions this procedure has its limitations. A method of solving the problem of long span structures that seems to have possibilities, is the use of concrete arch ribs reinforced with small rails, or portions of rails, and sections flame cut from second-hand steel members. Because it is impractical to pre-determine which one of many kinds of steel or iron may be found in a bunch of second-hand rails, or the amount of deterioration that has taken place, it is natural to assume rather low working stress. The use of rail reinforcement then is a practical matter of obtaining materials rather than an example of the economical use of steel.

In many cases it is an economical procedure to use untreated timber spans, provided the timber is nowhere in contact with the ground, and reasonable care is taken in the design to avoid conditions where decay is liable to take place. A common example of this is the use of an untreated timber trestle on unreinforced concrete abutments or piers. This type of structure may have to be used now under conditions that would justify a more permanent type of structure. In such cases, provision should be made for constructing a more permanent type of superstructure at the end of the service life of the timber, which can be done in a variety of ways. A similar procedure may be followed in the construction of culverts under fills by using unreinforced side walls with a timber roof so constructed that a permanent concrete slab may be built underneath the timber at sometime in the future.

The construction of substructures seems to offer many opportunities for substituting less critical shapes such as rails or second-hand materials. Fig. 10 shows an example of where

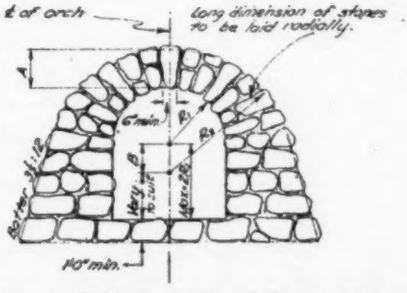


Fig. 7.—Typical section of 3-ft. to 6-ft. rubble masonry arch culvert

TABLE OF ARCH DIMENSIONS				
SPAN	R_1	R_2	A	B
3'-0"	1'-6"	3'-6"	1'-0"	1'-0"
3'-6"	1'-9"	4'-0"	1'-0"	1'-3"
4'-0"	2'-0"	4'-6"	1'-3"	1'-3"
4'-6"	2'-3"	5'-0"	1'-6"	1'-3"
5'-0"	2'-6"	5'-6"	1'-9"	1'-3"
6'-0"	3'-0"	6'-9"	2'-0"	1'-9"

TABLE I.
Three-Foot to Six-Foot Rubble Masonry Arch Culvert Dimensions

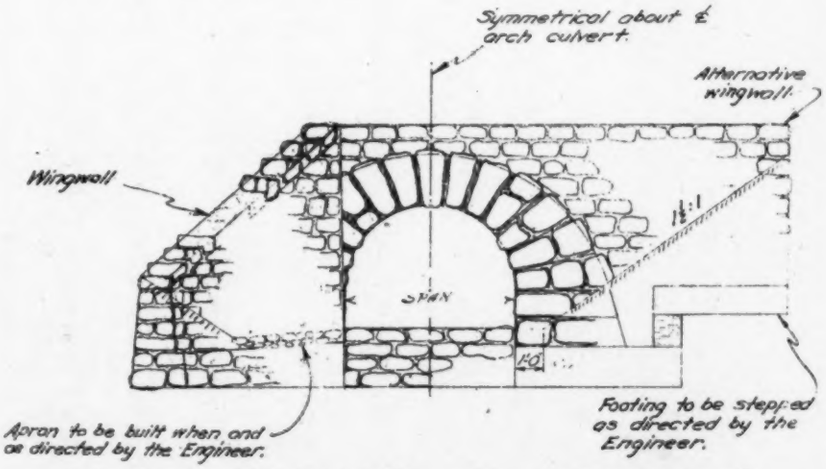


Fig. 8.—Elevation of 3-ft. to 6-ft. rubble masonry arch culvert with wing walls

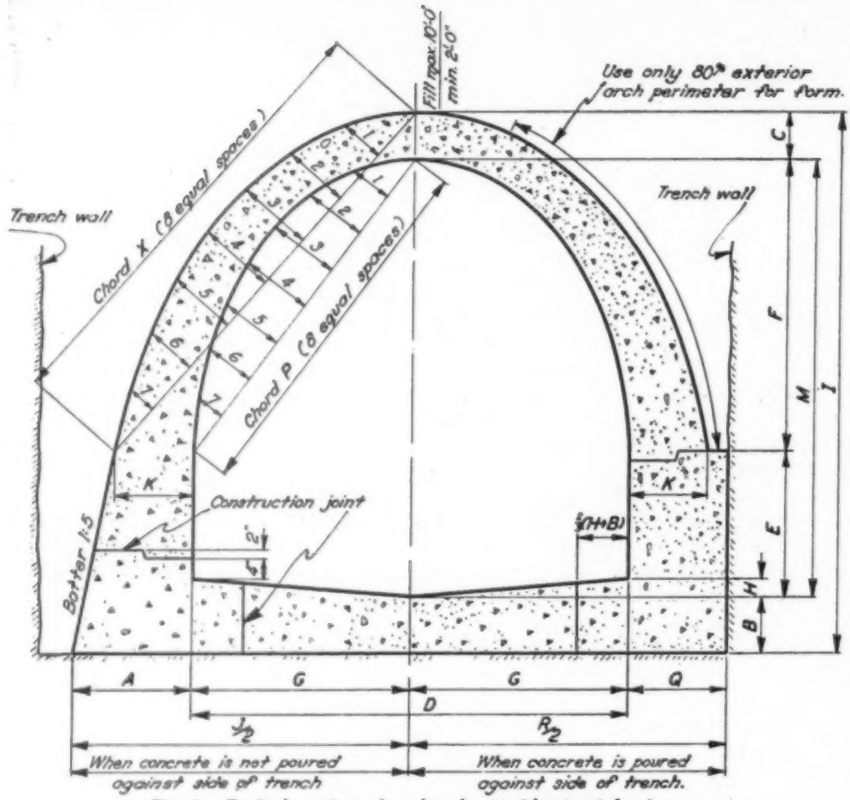


Fig. 9.—Typical section of arch culvert without reinforcing

such substitutions were made during the construction of a bridge designed in accordance with the usual specifications when work was held up on account of non-delivery of reinforcing steel. Rail sections have also been used for piles in railroad practice by welding three rails together in star shape but it should not be forgotten that the welding of high carbon rail sections together has its problems.

There will be many cases, such as grade separation structures and bridges in built-up areas, where head room is at a premium and long spans with shallow depths of girders or trusses are necessary. Under the conditions, maintenance and replacement of temporary type structures are likely to be difficult and seriously interrupt traffic when replacement becomes necessary. If a structure must be built under such conditions, it may be difficult and unsatisfactory to use anything but a standard design for steel or reinforced concrete. In this case, it is still possible to reduce the amount of critical materials that are normally used in the design, or at least to pick on the less critical

DIMENSIONS OF CONCRETE SECTION												CU. YDS. CONC. PER LIN.	WATER-WAY
M=D	A	B	C	E	F	G	H	I	J/2	R/2	K	Q	FT. SECT.	SQ. FT.
3'-0"	13 3/4"	7"	6 1/2"	1'-0"	2'-0"	1'-6"	1 1/2"	4'-1 1/2"	2'-7 3/4"	2'-5 7/8"	10"	11 7/8"	0.34	7.5
3"	14 1/4"	1/4"	"	1"	2"	7 1/2"	5/8"	4 3/4"	9 3/4"	7 3/4"	10 1/4"	12 1/4"	.37	8.8
6"	15"	1/2"	3/4"	2"	4"	9"	3/4"	8 1/4"	3'-0"	9 7/8"	10 3/4"	12 3/8"	.42	10.2
9"	3/4"	3/4"	"	3"	6"	10 1/2"	7/8"	11 1/2"	2 1/4"	3'-0"	11 1/4"	13 1/2"	.46	11.8
4'-0"	16 3/8"	8"	7"	4"	8"	2'-0"	2"	5'-3"	4 3/8"	2"	11 5/8"	14"	.50	13.4
3"	17"	"	1/8"	5"	10"	1 1/2"	1/8"	6 1/8"	6 1/2"	4"	12"	1/2"	.54	15.1
6"	5/8"	"	1/4"	6"	3'-0"	3"	1/4"	9 1/4"	8 5/8"	6"	3/8"	15"	.59	16.9
9"	18 1/4"	"	1/8"	7"	2"	4 1/2"	3/8"	6'-0 3/8"	10 3/4"	8 1/8"	7/8"	5/8"	.63	18.9
5'-0"	19"	9"	1/2"	8"	4"	6"	1/2"	4 1/2"	4'-1"	10 1/8"	13 1/4"	16 1/8"	.70	20.9
3"	1/8"	"	5/8"	9"	6"	7 1/2"	5/8"	7 3/8"	2 1/8"	11 1/8"	3/8"	3/8"	.73	23.0
6"	7/8"	"	3/4"	10"	8"	9"	3/8"	10 3/4"	4 7/8"	4'-1 3/4"	5/8"	3/4"	.78	25.3
9"	20 1/8"	"	7/8"	11"	10"	10 1/2"	7/8"	7'-1 7/8"	6 5/8"	3 1/2"	3/4"	17"	.83	27.6
6'-0"	5/8"	10"	8"	2'-0"	4'-0"	3'-0"	3"	6"	8 5/8"	5 1/4"	7/8"	1/4"	.89	30.1
3"	21"	"	1/4"	1"	2"	1 1/2"	1/8"	9 1/4"	10 1/2"	7"	14"	1/2"	.94	32.7
6"	1/2"	"	1/2"	2"	4"	3"	1/4"	8'-0 1/2"	5'-0 1/2"	8 7/8"	1/4"	7/8"	.98	35.3
9"	22 1/8"	"	3/4"	3"	6"	4 1/2"	3/8"	3 3/4"	2 5/8"	11"	3/4"	18 1/2"	1.03	38.1
7'-0"	23"	11"	9"	4"	8"	6"	1/2"	8"	5"	5'-1 1/8"	15 1/4"	19 1/8"	.12	41.0
3"	1/4"	"	1/4"	5"	10"	7 1/2"	5/8"	11 1/4"	7 1/4"	3 1/4"	3/4"	3/4"	.19	44.0
6"	24 1/2"	"	1/2"	6"	5'-0"	9"	3/4"	9'-2 1/2"	9 1/2"	5 3/8"	16 1/4"	20 3/8"	.26	47.0
9"	25 1/8"	"	3/8"	7"	2"	10 1/2"	7/8"	5 3/4"	11 3/8"	7 1/2"	3/4"	21"	.33	50.2
8'-0"	3/4"	12"	10"	8"	4"	4'-0"	4"	10"	6'-1 3/4"	9 3/8"	17"	3/8"	.42	53.5
3"	26 1/2"	"	1/4"	9"	6"	1 1/2"	1/8"	10'-1 1/4"	4"	11 1/2"	1/2"	22"	.50	56.9
6"	27 1/4"	"	1/2"	10"	8"	3"	1/4"	4 1/2"	6 1/4"	6'-1 5/8"	18"	5/8"	.57	60.4
9"	3/8"	"	3/4"	11"	10"	4 1/2"	3/8"	7 3/4"	8 3/8"	3 3/4"	1/2"	23 1/4"	.62	64.0
9'-0"	28 3/4"	13"	11"	3'-0"	6'-0"	6"	1/2"	11'-0"	10 1/4"	5 1/8"	19"	7/8"	.75	67.7
3"	29 1/2"	"	1/4"	1"	2"	7 1/2"	5/8"	3 1/4"	7'-1"	8"	1/2"	24 1/2"	.83	71.5
6"	30 1/4"	"	1/2"	2"	4"	9"	3/4"	6 1/2"	3 1/4"	10 1/8"	20"	25 1/8"	.92	75.5
9"	1/8"	"	3/4"	3"	6"	10 1/2"	7/8"	9 3/4"	5 3/8"	7'-0 1/4"	1/2"	3/4"	2.02	79.5
10'-0"	31 3/4"	13 1/2"	12"	4"	8"	5'-0"	5"	12'-1 1/2"	7 3/4"	2 3/8"	21"	26 3/8"	.12	83.6

TABLE II.—Dimensions of Arch Culvert Without Reinforcing

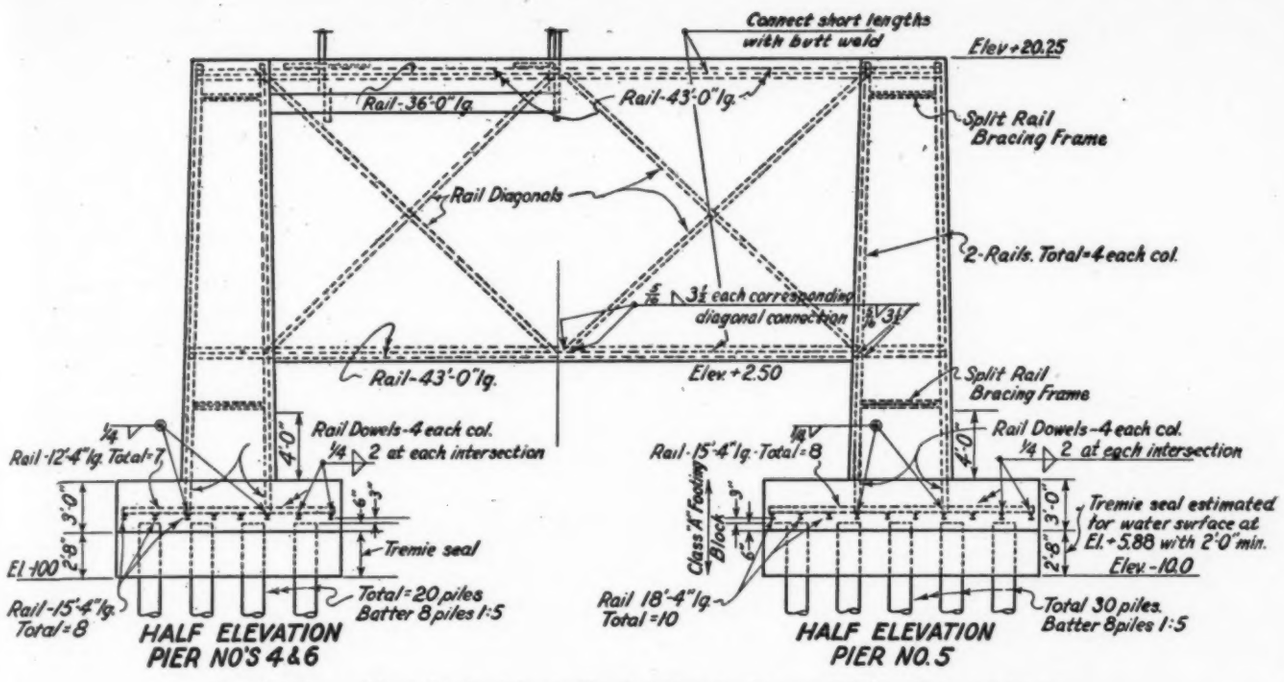


Fig. 10.—Pier and bent details of Eureka Slough bridge showing use of light rails for reinforcing

TEMPLATE																
INTRADOS								EXTRADOS								M=D
CHORD P	1	2	3	4	5	6	7	CHORD X	1	2	3	4	5	6	7	
2'-6"	3 3/8"	5 1/8"	5 7/8"	5 3/8"	5 3/8"	4 1/4"	2 3/8"	3'-5 3/8"	4"	6 1/4"	7 1/8"	7 1/8"	6 1/2"	5 1/8"	3"	3'-0"
8 1/2"	3/4"	5/8"	6 3/8"	6 3/8"	3/4"	1/2"	5/8"	8"	1/4"	1/2"	3/8"	3/8"	3/8"	5"	2 3/8"	3"
11"	7/8"	6"	7"	7"	6 1/4"	7/8"	7/8"	11 1/8"	3/4"	7 1/8"	8 1/4"	8 1/4"	7 1/2"	6"	3 1/2"	6"
3'-1 1/2"	4 3/8"	3/8"	3/8"	3/8"	3/8"	5 1/8"	3"	4'-1 3/4"	5"	5/8"	7/8"	7/8"	8"	3/8"	1/2"	9"
4"	1/2"	7/8"	7/8"	7/8"	7 1/8"	3/8"	1/8"	4 3/4"	1/8"	8"	9 1/8"	9 1/8"	1/8"	1/4"	3/4"	4'-0"
6 1/2"	1/8"	7 1/8"	8 1/8"	8 3/8"	1/2"	7/8"	1/4"	7 3/8"	3/8"	8"	1/4"	1/8"	3/8"	1/8"	4"	3"
9"	5 1/8"	3/4"	1/8"	7/8"	8"	6 1/4"	1/2"	10 1/2"	6"	9"	10 1/4"	10 1/8"	9 1/4"	7 1/8"	1/8"	6"
11 1/2"	3/8"	8 1/4"	9 3/8"	9 3/8"	1/2"	5/8"	3/8"	5'-1 3/8"	1/8"	1/8"	3/8"	3/8"	3/8"	1/2"	1/8"	9"
4'-2"	5/8"	3/8"	7/8"	7/8"	3/8"	7"	7/8"	4 1/4"	1/4"	1/2"	7/8"	7/8"	1/4"	3/4"	3/8"	5'-0"
4 1/2"	6"	9 1/8"	10 3/8"	10 3/8"	9 3/8"	1/4"	4 1/8"	6 1/8"	1/8"	10 1/4"	11 3/4"	11 3/8"	10 1/4"	1/8"	3/4"	3"
7"	1/4"	1/8"	3/8"	1/8"	3/4"	5/8"	1/4"	9 3/4"	7"	5/8"	12"	12"	5/8"	8 1/4"	3/4"	6"
9 1/2"	1/2"	10"	11 3/8"	11 3/8"	10 1/4"	8"	1/2"	6'-0 1/2"	1/4"	3/8"	1/2"	1/2"	11 1/4"	5/8"	1/8"	9"
5'-0"	7/8"	3/8"	7/8"	7/8"	5/8"	3/8"	3/4"	3"	5/8"	11 3/8"	3/4"	3/4"	3/8"	5/8"	3/8"	6'-0"
2 1/2"	7 1/8"	3/8"	12 3/8"	12 3/8"	11 3/8"	5/8"	3/8"	5 5/8"	8"	3/4"	13 1/2"	13 1/2"	7/8"	9 1/8"	5 3/8"	3"
5"	3/8"	11 1/4"	7/8"	7/8"	5/8"	9"	5 1/8"	8 5/8"	1/4"	12 1/4"	3/8"	3/8"	12 3/8"	3/8"	1/2"	6"
7 1/2"	3/8"	5/8"	13 3/8"	13 3/8"	12"	3/8"	1/4"	11 1/2"	1/2"	5/8"	14 3/8"	14 3/8"	5/8"	3/4"	1/2"	9"
10"	8"	12 1/8"	7/8"	7/8"	1/2"	3/4"	1/2"	7'-2 5/8"	7/8"	13 1/4"	15"	3/4"	13 1/8"	10 1/4"	6"	7'-0"
6'-0 1/2"	1/4"	1/2"	14 3/8"	14 3/8"	7/8"	10 1/8"	5/8"	5 3/8"	9"	5/8"	3/8"	15 1/8"	5/8"	3/8"	1/8"	3"
3"	1/2"	13"	7/8"	7/8"	13 3/8"	3/8"	7/8"	8 5/8"	1/2"	14"	16"	16"	14 1/8"	7/8"	1/4"	6"
5 1/2"	3/4"	3/8"	15 3/8"	15 3/8"	7/8"	3/8"	6"	11 5/8"	1/2"	3/8"	1/2"	5/8"	5/8"	11 1/8"	3/8"	9"
8"	9 1/8"	7/8"	7/8"	7/8"	14 1/4"	11 1/8"	1/2"	8'-2 1/2"	10 1/8"	7/8"	7/8"	7/8"	15 1/8"	3/8"	3/8"	8'-0"
10 1/2"	3/8"	14 1/4"	16 3/8"	16 3/8"	3/8"	1/2"	1/2"	5 1/2"	1/2"	15 3/8"	17 1/2"	17 3/8"	1/2"	12"	7"	3"
7'-1"	5/8"	3/4"	7/8"	7/8"	15 1/8"	7/8"	5/8"	8 1/2"	3/4"	3/4"	18"	7/8"	3/4"	1/4"	1/8"	6"
3 1/2"	10"	15 1/8"	17 3/8"	17 3/8"	5/8"	12 1/8"	7/8"	11 1/2"	7/8"	16 1/4"	1/2"	18 3/8"	16 1/4"	3/8"	1/2"	9"
6"	1/4"	5/8"	7/8"	7/8"	16"	1/2"	7"	9'-2 1/2"	11 1/4"	1/2"	19"	3/8"	1/2"	3/8"	1/2"	9'-0"
8 1/2"	1/2"	16"	18 3/8"	18 3/8"	1/2"	7/8"	1/4"	5 1/2"	3/4"	17 1/8"	5/8"	19 3/8"	17 1/8"	13 1/8"	5/8"	3"
11"	3/4"	3/8"	7/8"	7/8"	17"	13 1/4"	1/2"	8 1/2"	3/8"	3/8"	3/8"	7/8"	3/8"	1/2"	3/4"	6"
8'-1 1/2"	11 1/8"	7/8"	19 1/4"	19 1/8"	5/8"	1/2"	5/8"	11 5/8"	12 1/4"	18 1/8"	20 5/8"	20 1/4"	18"	3/4"	7/8"	9"
4"	3/8	17 1/4"	7/8"	7/8"	7/8"	7/8"	7/8"	10'-2 1/8"	3/8"	1/2"	21 1/8"	7/8"	3/8"	14"	8"	10'-0"

TABLE II.—Dimensions of Arch Culvert Without Reinforcing

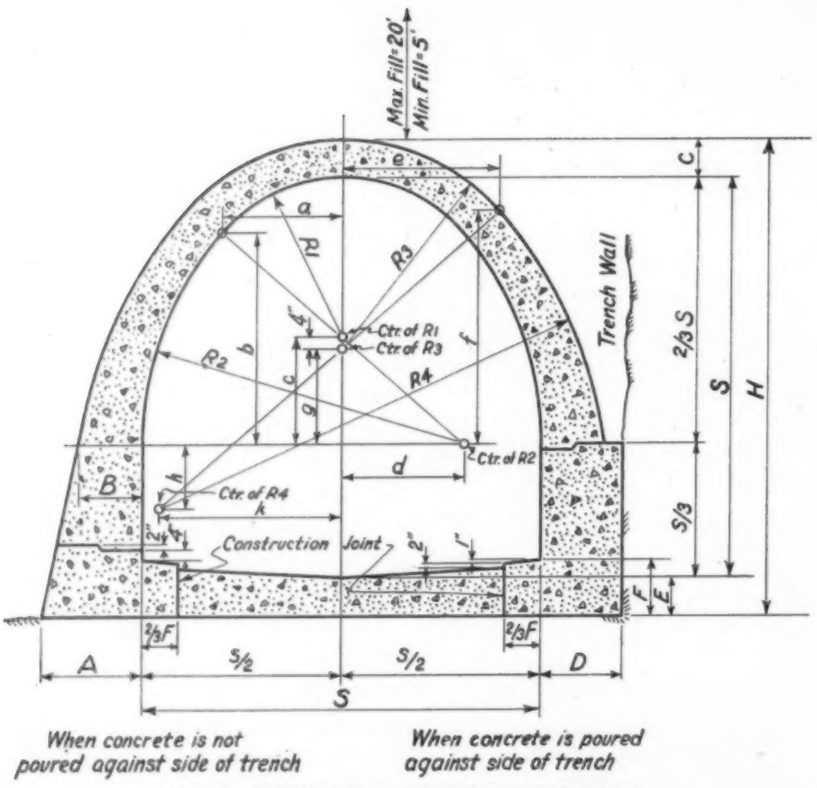


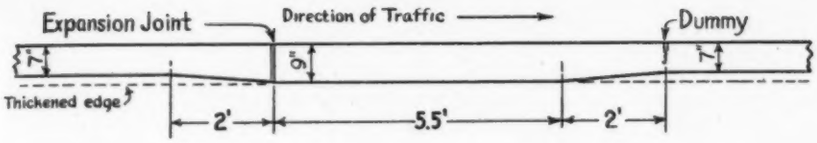
Fig. 11.—Typical section of gravity type arch culvert

shapes. This must be done, as already stated, even though it increases the total cost. In the general use of structural shapes or reinforciang bars, provision should always be made for substituting one size for another in order to use those sizes available in regional stocks. At the present time it is found to be more practicable to obtain reinforcing steel than to get structural shapes, which situation naturally prescribes the use of reinforced concrete bridges wherever possible. In the case of reinforced concrete, the job is then to reduce the amount of steel in the superstructure as compared to concrete. In a beam this can be done by arbitrarily increasing the depth of the section over that which results from following the accepted design specifications, or a similar result can be obtained by using a lower allowable stress for concrete in compression or a lower value of "n." (The A.A.S.H.O. has recommended dropping the allowable stress in concrete to a value of 700 lb. psi.) Naturally, no compression steel will be used in concrete beams unless headroom is at a great premium. There are many possible revisions in structural design practice, which have been discussed by engineers during the past few years, that would lead to generally lower costs of construction. Although it is evident engineers should make every effort at a time like this to arrive at an agreement on any revisions of present design specifications that will provide structures sufficiently strong for the work they must do, but less costly and

Span S	a	b	c	d	e	f	g	h	k	AREA OF WATERWAY	CU YDS. /LIN. FT.
12'-0"	3'-7 3/8"	6'-4 1/4"	3'-2 3/8"	3'-8"	4'-8 15/16"	7'-0 1/8"	2'-10 3/8"	2'-0 3/16"	5'-7 3/16"	120.7 □'	2.83
14'-0"	4'-2 5/8"	7'-5"	3'-8 13/16"	4'-3 5/16"	5'-5 5/16"	8'-1 13/16"	3'-4 13/16"	2'-1 7/8"	6'-4 3/8"	164.1	3.60
16'-0"	4'-9 7/8"	8'-5 11/16"	4'-3 3/16"	4'-10 11/16"	6'-1 11/16"	9'-3 1/2"	3'-11 3/16"	2'-3 1/2"	7'-1 5/8"	214.2	4.45
18'-0"	5'-5 1/8"	9'-6 7/16"	4'-9 5/8"	5'-5 15/16"	6'-10 1/16"	10'-5 9/16"	4'-5 5/8"	2'-5 1/8"	7'-10 13/16"	270.7	5.40
20'-0"	6'-0 5/16"	10'-7 1/8"	5'-4"	6'-1 5/16"	7'-6 7/16"	11'-6 7/8"	5'-0"	2'-6 13/16"	8'-8 1/16"	334.1	6.42

Span S	S/3	A	B	C	D	E	F	H	R1	R2	R3	R4
12'-0"	4'-0"	3'-0 3/8"	24"	14"	2'-6 1/4"	14"	1'-8"	14'-4"	4'-9 5/8"	9'-8"	6'-3 5/8"	13'-8 3/4"
14'-0"	4'-8"	3'-4 1/2"	26 1/4"	15 1/2"	2'-9 3/8"	15"	1'-10"	16'-6 1/2"	5'-7 3/16"	11'-3 5/16"	7'-2 11/16"	15'-8 1/16"
16'-0"	5'-4"	3'-8 1/2"	28 1/2"	17"	3'-0 1/2"	16"	2'-0"	18'-9"	6'-4 13/16"	12'-10 11/16"	8'-1 13/16"	17'-7 7/16"
18'-0"	6'-0"	4'-0 1/2"	30 3/4"	18 1/2"	3'-3 5/8"	17"	2'-2"	20'-11 1/2"	7'-2 3/8"	14'-5 15/16"	9'-0 7/8"	19'-6 3/4"
20'-0"	6'-8"	4'-4 5/8"	33"	20"	3'-6 7/8"	18"	2'-4"	23'-2"	8'-0"	16'-1 5/16"	10'-0"	21'-6 1/16"

TABLE III.—Gravity Type Arch Culvert Dimensions



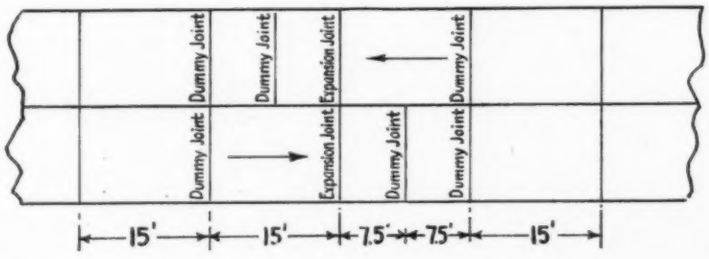


Fig. 12.—Top, longitudinal section, bottom, plan, showing spacing of dummy points adjacent to expansion joints when dowels are eliminated

wasteful of material, it is a problem that involves many factors. Improvements in design mean more men and equipment employed in making tests and collecting data. The more accurate methods of analysis that are a part of more economical designing require more man-hours in the design room which, because of the present demands on engineering talent, may mean a delay in starting construction. It is a field, however, in which many engineers physically unable to take part in the more strenuous tasks of mass production, could be employed to advantage.

Other "priority" materials used in bridge design include rubber for expansion joint materials, copper for water stops and bronze for bearing plates. There is also a great deal of structural and cast steel used in forming expansion joints and for rockers, as well as steel drains and culvert pipe. It is possible, in most cases, to avoid or greatly reduce the use of such materials by revising the common practice in the design and use of such details and by using other kinds of culvert pipe. Aluminum paint and galvanizing involve critical materials for which satisfactory, though sometimes less desirable, substitutes are available.

Pavement Redesign

Changes likewise have been made in the design of pavements in order to save steel. The most important means of doing this is by eliminating the steel dowels at the expansion joints. Experience has shown that some means must be provided to maintain the vertical alignment of the slab ends where, if dowels are omitted, a "step off" develops, almost invariably due to a depression of the forward slab. The amount of this depression depends on the quality of the sub-grade material and the settlement usually results in a transverse crack through the pavement of a few feet from the joint. Fig. 12 illustrates one method of taking care of this action and preventing adverse results. The cracking is taken care of by placing a weakened plane 7.5 ft. from the expansion joint and thickening the pavement in between to reduce settlement under impact or to resist the stresses which will result if settlement does occur. Fig. 13 shows a modification of a method which has been previously used, in which a lap joint supports the forward slab instead of dowels. The pavement edges are also

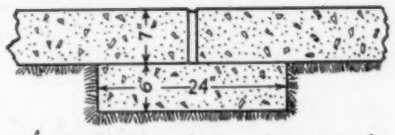


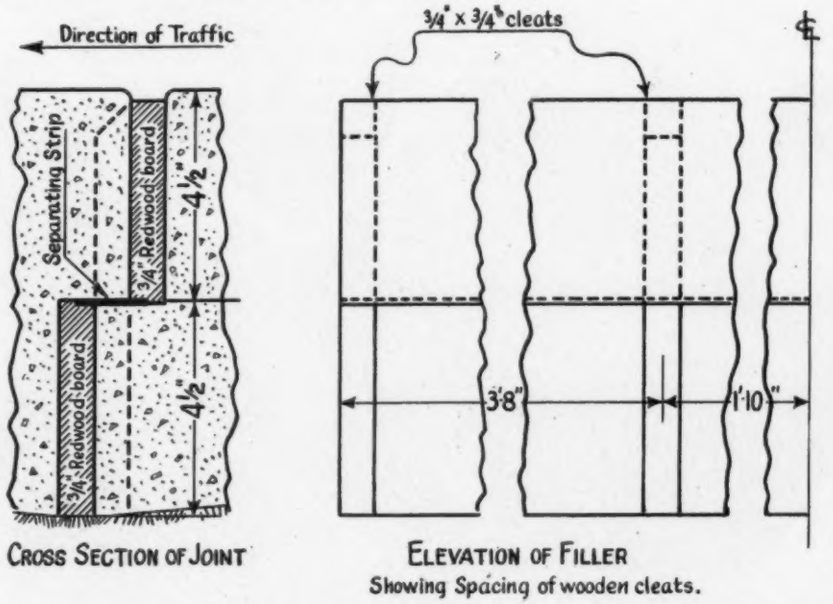
Fig. 14.—Showing design of support for longitudinal joint when dowels are eliminated

thickened in this case to take care of the additional impact stresses at the joints.

Wooden side forms for pavement construction naturally will be used more and more as the existing supply of steel forms wears out. California uses redwood of a specified quality for expansion joint filler which replaces more common but less available materials. It is also the practice to permit the use of available plant and equipment instead of preferred types, as long as reasonably satisfactory results can be obtained. As in bridge construction, the changes being made in the construction of pavements to take care of the present situation do not result in any material reduction in the quality of the finished product but they may not always be as economical a procedure as normal conditions would require.

Interchange Ideas

It is plain that in treading on new ground like this, engineers must feel their way to some extent. There are no exact rules based on past procedure upon which they can agree in checking one anothers plans and they must always be ready to make changes whenever new and better ideas are advanced.



Note: Separating strip may be composed of ⅛" "Masonite" or similar plastic

Fig. 13.—Showing design in which lap joint supports forward slab when steel dowels are omitted

Modernization Cuts

INCREASED efficiency and lowered costs of reconstruction and maintenance of Audubon County, Iowa, roads has been effected through the purchase of new tractor powered equipment. With the exception of a few old models remaining to be traded, their new setup of machines includes the following:

- 2 International TD18 crawler tractors
- 1 International TR14 crawler tractor
- 1 International TD9 tractor
- 4 Adams 12-ft. motor graders
- 1 Galion 12-ft. motor grader
- 1 Adams 42-in. elevating grader

County Road Costs

Casting with Adams elevating grader to raise roadbed

This 2½yd. scraper pulled by an International tractor, is used exclusively for maintenance

Mr. Herbert F. Wickenkamp, County Engineer, is responsible for the economies resulting from modernization

1 Bucyrus-Erie 8-yd., 4-wheel scraper
1 Bucyrus-Erie 4-yd., 2-wheel scraper
1 Bucyrus-Erie 2½-yd., 2 wheel hydraulic scraper
1 Bucyrus-Erie Bullgrader No. 20-21

The purchase of this new equipment and change in operating methods began in 1939 with the employment of Mr. Wickenkamp as County Engineer. Investigation of costs of operation indicated that $12,000 a year for three years could be put into new equipment.

Before the change the roads had been maintained with blades, but not brought to grade. In 1940 permanent grades were started, and one new outfit brought 30 miles to grade as compared with 40 miles previously maintained only with three outfits.

The cost of these 30 miles of permanent grade was 2.48 cents per cu. yd. including everything, as figured from a cross section of two average miles.

"No Metal" Expansion, Contraction and Load Transfer Joints

By H. J. FIXMER
Assistant Engineer, Bureau of Streets, Chicago, Ill.

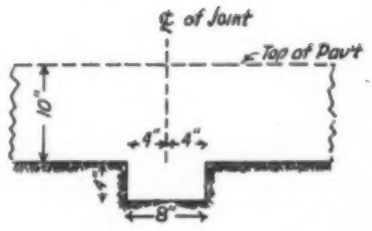


Fig. 1

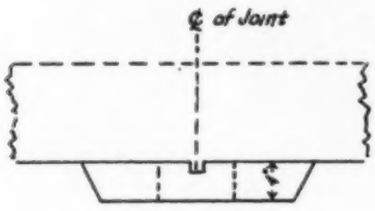


Fig. 2

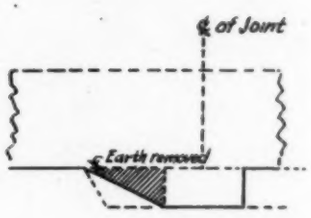


Fig. 3

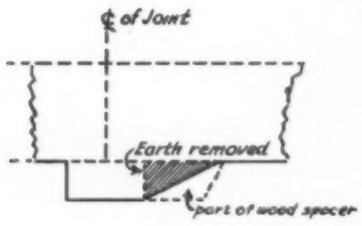


Fig. 4

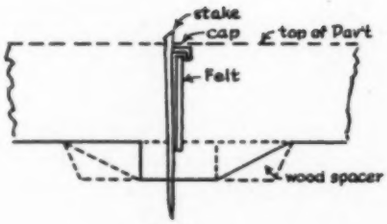


Fig. 5

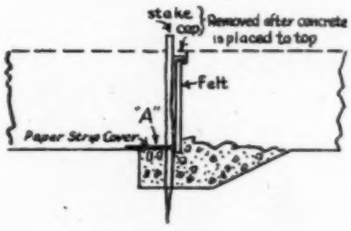
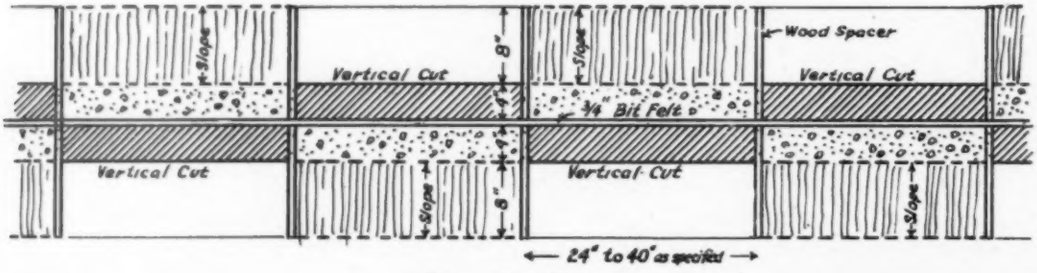
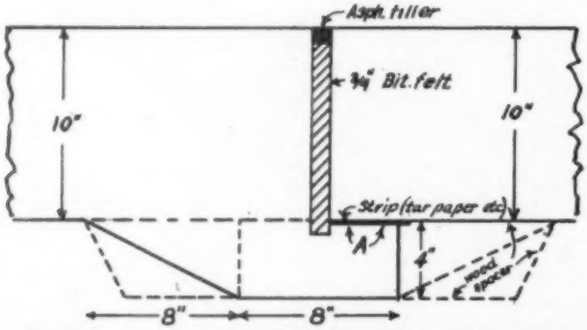


Fig. 6

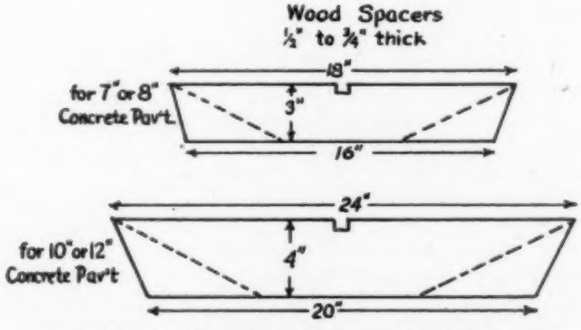


Plan. Fig. 7



Section view of completed Expansion and Load Transfer Joint

Fig 8



Width of slot made to fit width of Bit. Felt or Plate

Fig 9

Pavement thickness	WOOD SPACER				TRENCH SIZE		
	width	top length	bottom length	thickness	depth	bottom	slope on alternate sides
7"	3"	18"	16"	½"	3"	6"	6"
8"	3"	18"	16"	⅝"	3"	6"	6"
9"	3½"	20"	18"	⅝"	3½"	7"	7"
10"	4"	24"	20"	¾"	4"	8"	8"
12"	4"	24"	20"	¾"	4"	8"	8"

Sequence of Operations

1. Fig. 1.—Cut trench along center line of joint, 4 in. deep and 8 in. wide.
2. Fig. 2—Place wood spacers 24 in. to 40 in. apart. Press into soil—Fig. 7.
3. Figs. 3 and 4.—Slope subgrade on alternate sides—Fig. 7.
4. Fig. 5.—Place ¾ in. by 10 in. bituminous felt in spacer notch. Set cap and stake.
5. Place concrete by shovel in trench even with subgrade on "A" side.
6. Fig. 6.—Strike off top of tongue at "A" even with top of wood spacer and top of subgrade.
7. Lay tar paper strip at "A" and tack to top of wood spacer.
8. Concrete and finish slab as usual.
9. Fig. 8.—Tar paper strip 5 in. wide by length between spacers plus 1 in. to be tacked down after top of concrete at "A" is struck off even.
10. For expansion joint use ¾ in. to 1 in. bituminous felt. For contraction or construction joint use No. 16 metal or fabric plate ⅛ in. thick.

Advantages

a. Provides thickened edge at free joint.
b. Provides interlocking support, neither slab can rise or fall with respect to adjacent slab.
e. Stronger, smoother joint. Bituminous felt held in place at bottom.
d. Steel eliminated.
e. Expansion between slabs above subgrade taken by ¾ in. bituminous felt; below subgrade 4 in. concrete tongue bears against compressible earth.
f. Waterproof. Water sealed away from subgrade and rotting of felt strip at bottom prevented.

"No metal" construction joint
TYPE I

Recessed in joint in concrete after removal of forms.

A = 2 in. by 10 in. side form.
B = 1 in. by ¾ in. by 1½ in. cleat attached to "A."
C & D = 1 in. by 1½ in. by 1½ in. cleats nailed with double headed nails from back face of "A."

Oil inside face of "A" and exposed faces of B, C and D

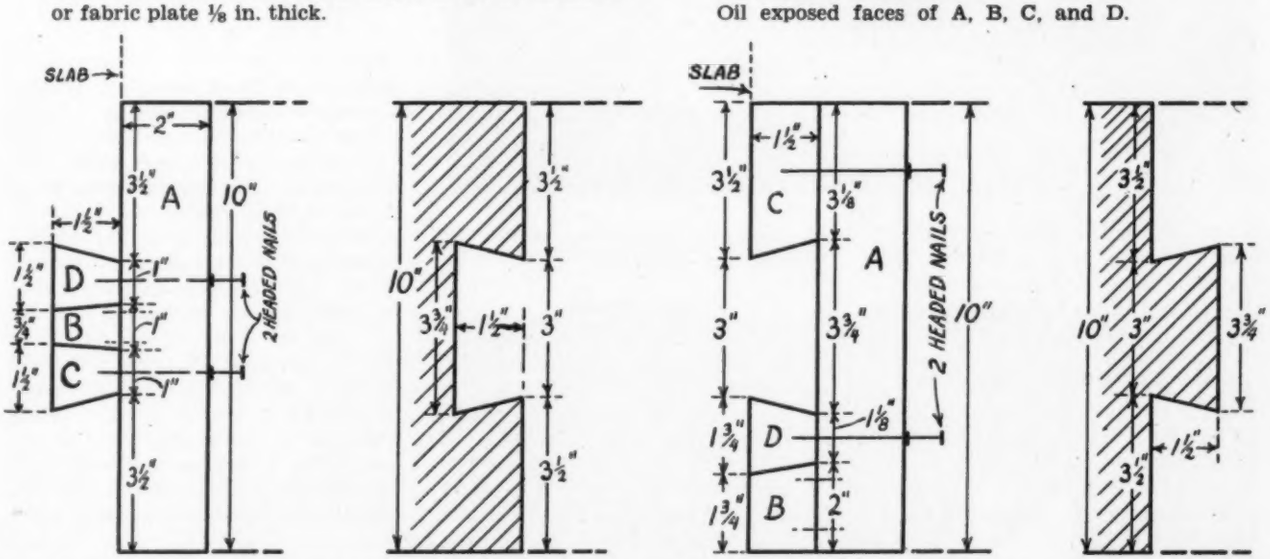
This joint may be used between slab and curb and gutter, or for center joint, construction joint, or longitudinal joint.

"No metal" construction joint
TYPE II

Key joint in concrete after removal of forms.

A = 2 in. by 10 in. side form.
B = 1¾ in. by 2 in. by 1½ in. cleat attached to "A."
C = Top cleat, 1½ in. by 3⅛ in. by 3½ in. held in place by double headed nail.
D = Middle cleat, 1¾ in. by 1⅛ in. by 1½ in. held in place by double headed nail.

Oil exposed faces of A, B, C, and D.



Eliminates metal tie bars and metal or fiber plate. After concrete has set pull out the 2 headed nails prior to pulling off side forms. "B" moves away when "A" is removed. "C" and "D" then are easily removed for continued use. Countersunk bolts could be used in place of double headed nails.

Protect Children from Blasting Caps

All users of explosives are being asked to cooperate in the movement to protect children from the dangers of playing with blasting caps. Although warnings against allowing these caps to fall into the hands of children are contained in each box of caps, records show that many of them are left lying carelessly about. Those who use explosives can make themselves the most important factor in the movement to save children from injuries and sometimes death by making sure that the caps are carefully stored away where boys and girls cannot get them.

Accidents to children from playing with blasting caps decreased in 1941 as compared with 1940. The desire this year is to eliminate these dangers as completely as possible. It is felt that this can be done if there is wholehearted cooperation on the part of all.

OBSERVATIONS BY THE WAY

By
A. PUDDLE JUMPER

¶ An interesting spot out Wickenburg (Arizona) Way is this roadside rest. The water is fine. One feels refreshed and much freer after reading the tablet, which says:

Hassayampa Legend

There's a legend centuries old,
By the early Spaniards told,
Of a sparkling stream that "lies"
Under Arizona skies.
Hassayampa is its name,
And the title to its fame,
Is a wondrous quality
Known today from sea to sea.
Those who drink its waters bright,
Red man, white man, poor or knight,
Girls or women, boys or men,
Never tell the truth again.

Andrew Downing.

• •

¶ The following sign is posted by the roadside as you enter a western town:

4076 people died last year of gas.
29 inhaled it.
47 put a lighted match to it.
4000 stepped on it.

¶ From an anonymous source we received the following:

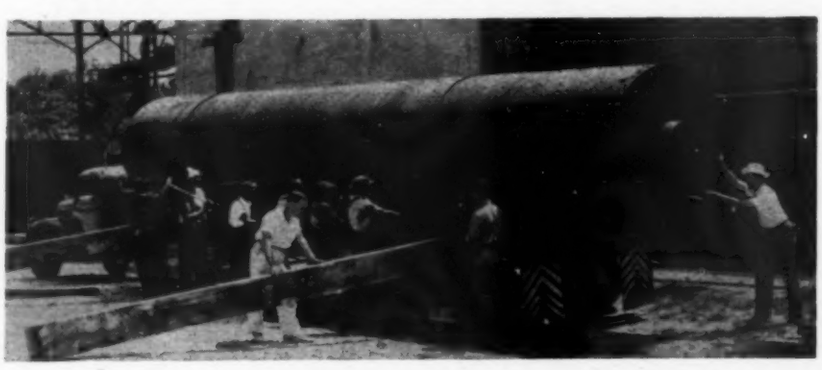
Air Raid

(Instructions For Civilians)

1. As soon as bombs start dropping, run like Hell. It doesn't matter where you run as long as you run. Wear track shoes if possible. If the people running ahead of you are slow or fall down, you won't have any trouble passing them, or jumping over them.
2. Take advantage of opportunities offered you when air raid sirens sound the warning of attack, or of blackouts.
   (a) If its a bakery—grab a pie
   (b) If its a tavern—grab a beer
   (c) If its a movie—grab a blond
3. If you find an unexploded bomb, pick it up and shake—maybe the firing pin is stuck.
4. If an incendiary bomb is found burning in a building, throw gasoline on it, you can't put it out anyway, so you might as well have a little fun.
5. When the first bomb falls, holler like bloody-murder. It will add to the confusion and scare hell out of the kids.
6. It's well to have onions or limburger cheese handy as a snack before entering a crowded air raid shelter. It may make you unpopular, but you will have more room for yourself.
7. If you should be a victim of a direct hit, don't go to pieces. Just be still and the clean-up squad will take care of you.

• •

¶ A heavy load! The big cylindrical object in this illustration is a crushed rock dryer weighing 23-tons. When Osborne & Company, an Alabama contractor, has to move it from place to place it is rolled onto a big flat-bed Fruehauf trailer and taken on its way.



¶ *Interesting? Information:* In some recent discussions of coarse aggregate sizes, Stanton Walker, Director of Engineering, National Sand and Gravel Association, hit on the idea of using a coin to illustrate the size of an aggregate particle. He was somewhat surprised to learn the diameters of common coins. They are:

Coin		Approx. Dia. in.	Approx. Equiv. Sq. Openings
1.00	=	1.50	1.25
0.50	=	1.20	1.0
0.25	=	0.95	0.8
0.05	=	0.83	0.7
0.01	=	0.75	0.62
0.10	=	0.70	0.58

• •

¶ In Missouri this outfit cuts 25 to 30 miles a day. There is a 5 ft. mower bar on the tractor which pulls two

6 ft. mowers. Note the warning flags on the pole on the tractor. This gives drivers from the rear a warning when hilltops intervene.

• •

¶ A Colorado truck driver adopted a rather complicated method of keeping warm. To get out of the wind and cold last January he crawled into the dump body.

A power shovel operator dumped a load of dirt and gravel into the truck.

When the truck didn't pull away, fellow workers figured out the reason.

They tipped up the truck's dump bin. Out poured the dirt and under it the driver, buried a second time.

Before he could be dug out, the truck had to be moved.

The wheels ran over his legs, but they were covered with dirt deep enough so they weren't crushed.

Pulled out spluttering, the driver stayed on the job, though slightly bruised.

• •

¶ The farmer was sitting on the steps in front of the farm house, eating a sandwich, when a hen went past him like a shot. A rooster was in pursuit, but he suddenly put on the brakes and stopped to eat the crumbs that fell from the farmer's sandwich. Very much surprised, the farmer looked at the rooster, shook his head and muttered: "I hope I never get that hungry."—*The Yellow Strand.*

¶ Contributing their bit in the war effort to the elimination of wasted man-hours the Bridge Department drafting room of the California Division of Highways posted this picture on their front door. F. W. "Pan" Panhorst, Bridge Engineer, thinks it's a good idea and feels that others will appreciate the idea.

• •

¶ Says the Minnesota Department of Highways in their Jan. 26 Highway News:

"These surface improvement and restorative operations involved 635 miles of scarifying and killfering." Pray tell—what is killfering?

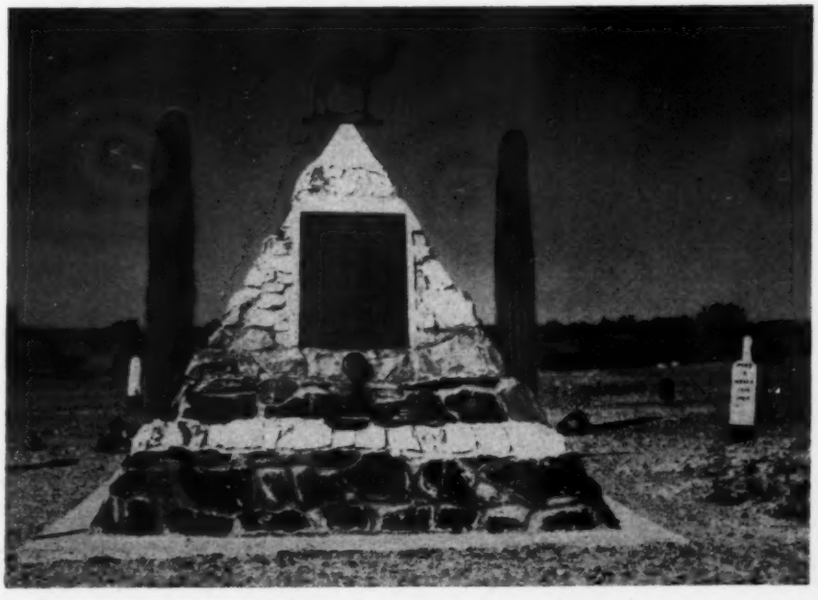
• •

¶ Smile and the world trades with you—weep and you keep your goods.

¶ "Now, ladies and gentlemen," screeched the political orator, "I want to tax your memory!" "Great grief!" groaned a man in the audience, "Has it come to that?"—*Underwriter's Review.*

• •

¶ I published a picture I took of this memorial years ago before the spot was landscaped. It is a monument to Hi Jolly as Haidji Ali the old camel transport driver was known, who tried, before the advent of the railroad in our great Southwest, to set up a camel caravan transport system. The monument is along U. S. 60-70 in western Arizona. The stony terrain cut the feet of the animals and Hi Jolly had to abandon the enterprise.



Blue Ridge Parkway Nears Completion

Keeley Construction Company Grades 10 Miles in Rugged Area

BY continuous digging, shooting, loading, hauling the Keeley Construction Company, of Clarksburg, West Virginia, on its contract for grading 10.219 miles of parkway road and 1.724 miles of approach roads rapidly brings the famous Blue Ridge Parkway near completion. Conceived in 1933 to connect the Shenandoah National Park in Virginia with the Great Smoky Mountains National Park in North Carolina, Tennessee, the Blue Ridge Parkway winds for some 485 miles along the crests of the Blue Ridge Mountains at an average elevation of about 3,000 feet above sea level, and through a park-owned right-of-way averaging 800 feet in width.

Keeley's job is an intermediate section of the parkway in Rockbridge and Nelson Counties, Virginia, and extends in a roughly southwesterly direction from Tye River Gap, near the towns of Vesuvius and Montebello. It opens up, as was the case with most other sections of the parkway, a hitherto virtually inaccessible area of bold panoramas and wild forest.

Le Tourneau scraper picking up load. Note how operator keeps preformed cable taut to prevent fouling

Koehring gas-powered W-60 Dumptor making fill on side-hill section. Lorain 79 shovel in background

Construction Items

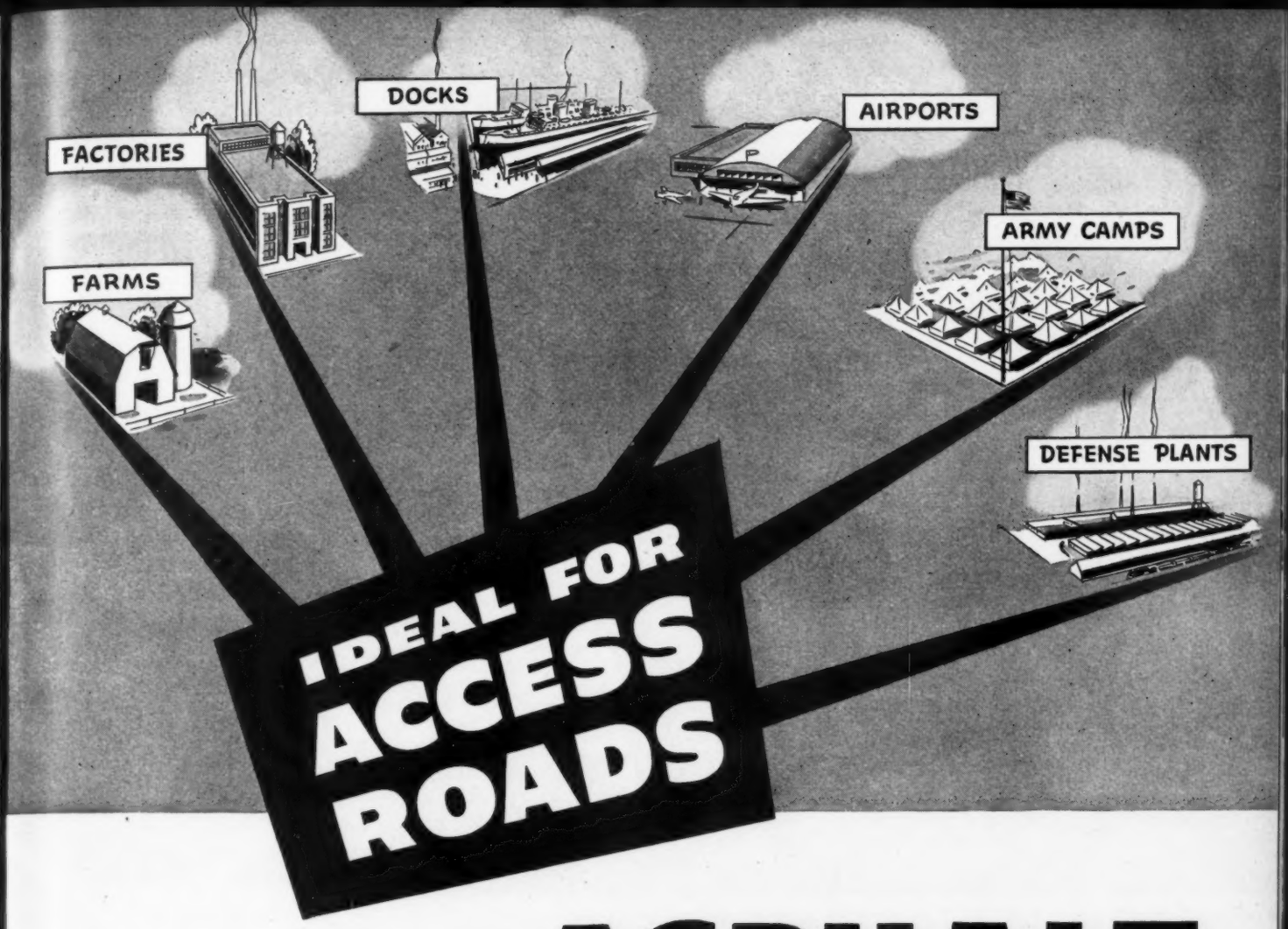
The contract called for some 730,000 cubic yards of excavation on the parkway, 8,700 cubic yards of excavation for structures, and 5,000 cubic yards of excavation for borrow. All excavation was unclassified, but according to Tom Mays, the contractor's superintendent, at least 30 percent had to be blasted out in cutting grades down to the project's maximum of 7.03 percent and in building curves to the minimum radius of 204.63 feet.

None of the cuts or fills on the project involved spectacular yardages, the biggest rock cut representing the removal of only 22,371 cubic yards, but practically all cuts of any appreciable depth went down into ledge rock. Jackhammers were used in drilling blast holes and air was supplied by two Gardner-Denver portable compressors. Atlas black powder and Atlas 40 percent gelatin were used for blasting, the choice of explosive being dictated by conditions.

Equipment Output

Shattered rock was loaded out with a 1½-yard diesel-powered Lorain 79

(*Continued on page* 47)



STANDARD OIL ASPHALT

● Highway traffic is the blood stream of the victory production program. Miles of improved, widened, and new highways are needed to link together the food and material production centers, defense plants, army camps, and airports. Asphalt construction provides a means of supplying these vital arteries of industry now, when they are needed, because:

- **Asphalt** requires the minimum amount of time between the start of the paving job and the final load-carrying finish.
- **Asphalt** roadways can frequently be built with local aggregate. A big saving in transportation time and expense.
- **Asphalt** construction requires only equipment that is readily available.
- **Asphalt** surfaces can be quickly restored to service when damaged, even if by enemy bombs!

Wherever Standard Oil Asphalt products are sold, there is a Standard Asphalt Representative who can give you full information about its application to your problem. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the representative nearest you.

OIL IS AMMUNITION — USE IT WISELY

ASPHALT FOR EVERY PURPOSE

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(INDIANA)

THIS BRUTE SAVES ITS BREATH...

This two-fisted, rugged rock drill stays on the job longer — with no air-wasting "back-talk."

Worthington's Blue Brute Rock Drill (WJ-55) saves *your* breath, too, for you don't waste hell and damnation on a tool that is easy on the operator and rarely interrupts the work for maintenance and repairs.

All Worthington Blue Brutes are like that. Rock drills and air tools, designed for a complete range of jobs . . . from hardest rock to clay or fitchery earth . . . *use less air,* cause less trouble, save time and money in the long run. Portable and semi-portable compressors . . . gasoline-driven, diesel, electric . . . equipped with Worthington's time-tested "Feather Valves" . . . *deliver more air,* more smoothly, more economically.

Get a demonstration, *now, on your present job,* of how Blue Brutes will help you get more WORTH from air!

FREE EQUIPMENT SAVER

Ask your nearest Worthington distributor, listed on page 47, for the free EQUIPMENT SAVER which shows you how to conserve scarce metals, lowering maintenance costs for all Blue Brute users from coast to coast. If your distributor is not listed, let us send you this free cost-cutting aid to efficient production direct from Holyoke.

On the Job with

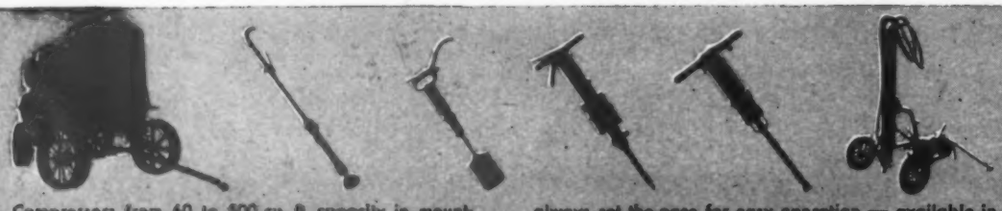
BLUE BRUTES

A Worthington Blue Brute WJ-55 Rock Drill, on trial at a western quarry, made such a hit with the operators that they tried to keep it by *hiding* it when the trial was over! Said the Super, after buying: "It out-drills all our competitive makes by 2 or 3 inches per minute."

On hundreds of army, navy, air-force and ordnance projects all over the country, Blue Brutes are at work.

Get more WORTH from air with WORTHINGTON

BUY BLUE BRUTES



Compressors from 60 to 500 cu. ft. capacity in mountings to suit all jobs. Rock Drills and Air Tools that have always set the pace for easy operation — available in a wide range of weights and sizes.

WORTHINGTON

Worthington Pump and Machinery Corporation, Harrison, N. J. Holyoke Compressor and Air Tool Department, Holyoke, Massachusetts

General view of scraper-dug cut on curve. Angledozer in center

(*Continued from page* 44)

shovel into four Koehring W-60 Dumptors. Distances from rock cuts to fills varied from only a few feet in the case of some sidehill excavations to as much as 2,500 feet. Haul roads were quite rough, but the Dumptors were able to maintain speeds amply sufficient to keep the shovel busy continually. Rough grading of fills was done with a La Plant-Choate angledozer.

For large-quantity earth excavation, a total of more than 500,000 cubic yards, the Keeley Construction Company relied on a Le Tourneau rooter and two 15-yard Le Tourneau scrapers. These were followed on the fills by two Le Tourneau angledozers. Wire rope on this equipment was ½-in. preformed 6 by 19 improved plow steel with independent wire rope center.

Because of the impossible working conditions during the winter months, as well as during the early spring and late fall, the contractor was forced to work at top speed during the "open season." A skilled mechanic was constantly on the job, supervising maintenance and making every effort to anticipate and forestall the need for major repairs. Not only would interruptions to work be costly, but also the nearest machine shop was many miles away, making shutdowns for repairs even lengthier than would normally be the case. Operators were cautioned to handle equipment with great care, and they responded satisfactorily.

The management of the job itself also made it possible to handle more yardage without overstressing the equipment. For instance, in several cuts the scrapers could load and dump while travelling in either direction through the cuts. A typical

Gardner-Denver compressor and jackhammers in shallow cut

Rock cut on curve

example was at the southwesterly end of the project where a 15,000-cubic-yard notch had to be cut through a hump around a horizontal curve. Original grade along the center line was about 16 percent on one side of the hump and about 10 percent on the other side. Approximately equal amounts of fill were to be deposited at each end of the cut. Material in this particular cut was thin topsoil, earth, clay, sandstone and some decomposed granite near the bottom. Loading was accomplished in each direction in about 0.93 minutes, with an average loading distance of 108 feet. Pushers were used occasionally but not habitually. Haul was about 125 yards each way from the center of the cut down a gradually decreasing grade which averaged about 12 percent for the entire operation. Most dumping was done while turning on the narrow fill, material being spread over a distance of about 30 feet in an average of 0.61 minutes. Average total round trip time was 3.87 minutes and each scraper dumped about 15½ loads per hour.

The rooter, sometimes aided by a pusher, was able to loosen most of the sandstone near the bottom of this cut and the decomposed granite was shattered sufficiently by blasting so that the scrapers could load it, too. The two angledozers were kept busy on rough grading at the fills at either end of the cut, although once in a while called upon to do some pushing of scrapers or rooter.

Unloading when the scraper and tractor are in a sharp turn is hardly recommended practice, as the cables are likely to become fouled unless the operator is careful. However, these operators were skillful and cable breakage was comparatively little throughout the whole job. Preformed cable contributed mainly, of course, to the longer cable life. The contractor feels that preformed rope gives greater flexibility to Lang lay, so necessary for sheaves with a 9½-inch tread diameter, although Lang lay in non-preformed is cranky and hard to handle.

Surfacing

The contract called for the construction of a gravel roadway 20 feet wide, resting on a crushed stone base 8 inches thick. As an interesting comment this crushed stone base was a windfall for the men and boys from the farms in the area. For years they struggled and sweated at removing boulders from their fields. Along came the Keeley Construction Company and offered 40 cents a ton for field stones delivered at and loaded into a crusher. Much if not most of the stone encountered in rock cuts was not suitable for road base, hence this opportunity for the local farmers.

Grading roadway before 8-in. crushed stone base is applied

Pioneer crushing plant reduced field stone to three sizes

The primary crusher was big enough to take any boulders that the local farmers were likely to be able to load onto a truck, being a Pioneer 18-in. by 36-in. jaw crusher. A bucket conveyor fed crushed stone to a vibrating screen with ¼-in., ½-in. and 1¼-in. square openings through which the stone passed to bins beneath. Oversize, scalped off the screen, was fed into a Pioneer single roll secondary crusher from which it was discharged into the boot of the bucket conveyor and put into circulation again. The entire crushing plant was manufactured by Pioneer Engineering Works, except the power plant. The parkway is the biggest construction job that has ever been done in this vicinity, giving employment to many local people, and making relatively high speed travel through the mountains possible for the first time.

Left, Tom Mays, superintendent for the Keeley Construction Co. Right, A. L. Cook, Chief Inspector, Public Roads Administration, Federal Works Agency

Personnel

Although the administration of the Blue Ridge Parkway is under the National Park Service of the Department of the Interior, the construction of the road itself is being done under the direction of the Public Roads Administration of which H. J. Spelman is District Engineer in Charge of Road Construction in National Parks. The parkway is designed exclusively for recreational purposes and commercial traffic is not allowed to use it. Nor is any attempt made to keep the road open during the winter months between November 15th and April 15th, during which period it is officially closed because of the dangerous amounts of snow and ice that accumulate.

For the Public Roads Administration the chief inspector was A. L. Cook. The general manager of the Virginia Division of Keeley Construction Company is J. K. McGrath and Tom Mays was superintendent on this job.

Galion for MOTOR GRADERS—ROLLERS

There's not much we can say about Galion road machinery that you don't already know . . . only that these versatile units are keeping steadily at it to bring the many Victory projects to a successful conclusion. As a reminder though, we are still in a war and we've a great big job ahead of us. Let's you and us get really conscious about it before it is too late. "We're in it . . . let's win it."

Illustrations show Galion motor graders in action—No. 101 blading material on a road widening job; No. 201 on new road construction on Trans-Isthmian highway in Panama.

GALION ROAD MACHINERY points to better roads

THE GALION IRON WORKS & MFG. CO.

Main Office and Works: Galion, Ohio

What Maneuvers are Teaching Us About Military Highways

By COLONEL JOHN W. WHEELER
113th Engineers, Camp Shelby, Mississippi

MILITARY highways must be thought of as a means of waging offensive war, or as a defensive means. Up until a short time ago, I believe, every American would have said, "We will never wage offensive war—defensive measures are all that we are interested in." The writer feels that there is little use of looking at defensive measures. In modern warfare, he who waits for the offender to come to his borders is lost. The great Notre Dame football coach, Knute Rockne, said, "Build up a good offense and the defense will take care of itself." Nothing could be more correct or better phrased to describe the military situation today.

Mobility of fire power now determines the victor of any battle. Mobility is determined by the vehicle and the roadway. You will remember that Hitler did not start fighting until he had finished his military roads, the "Autobahnen." While this nation has by far the greatest system of highways of any nation in the world, it must be remembered that up until recent years, no thought was given to military value in road location and construction. In general our interior roads, which were built without military thought, would be, and are of great military value as roads incident to production of munitions and supplies. The roads adjacent to our borders are not so well suited, because these areas are not our heavily populated areas and hence have few high type roads. Some carefully planned military highways are needed near our borders.

Military Road Requirements

Now let us consider what the 1941 maneuvers taught us with respect to highways. Highway engineers in civil life are not interested directly in the tactical road at the front, such as the 113th Engineer regiment might build and maintain (and incidentally a combat regiment with an infantry division is not expected to build any very good roads); nor are civil engineers interested in those built by Corps engineers or Army engineers, but more in the roads in the so-called theatre of operations.

Wide shoulders are of first importance. No matter how wide the road surface or pavement is made the shoulders should be 12 feet wide. No matter how light or poor the surfacing material is, make the shoulder 12 feet wide. Who knows what roads may become military highways? Let us make all shoulders 12 feet wide on all roads except where topography is so rugged that it is out of the question economically. Under general or ordinary conditions, it costs but little more at the time of construction to build 12 foot shoulders. Wide shoulders would give two extra lanes of traffic in emergencies. It would allow slow moving traffic such as refugees to move on the shoulders, while tactical vehicles used the roadway. It would allow slow moving transportation which may have to be animal drawn to use the shoulders, while the fast moving combat elements could use the roadway. "What about the bridges—each bridge will become a bottleneck." To prevent that military bridges will have to be moved onto any road with a narrow bridge at the time of its use. Perhaps certain preparations for military bridges at the sides of the regular bridge could be made prior to military operations such as the driving of treated timber pile abutments.

Provisions might well be made for taking vehicles off the road rapidly whenever there is cover such as trees, with a well worked out plan of putting them under cover of the forest and getting them back out on the road. This can be done at very little expense by merely building what is known as farm entrances opposite areas that afford cover to military columns.

The Offensive Road

It is not within the writer's province to in any way set U. S. military policy as to our aggressiveness, but assuming that we would rather be aggressive than vanquished, it may be said that in many strategic locations in this country systems of offensive military highways should be considered. It will be needless to try and go into detail as to where these should be or a definite plan of constructing them, and it will suffice to say that our highway system in the vicinity of our coast lines and borders should be adjusted so that we can move out rapidly and meet the enemy before he arrives in our territory; so that our own nation with its great system of production can remain unhampered to support its army. If we are to keep the enemy from invading our territory, we must be able to move our fire power quickly to any point that he may choose as his entrance into our nation.

Maneuver Experiences

Now let us examine a portion of the 1941 maneuvers which leads the writer to believe that the factors set out in this article, which is an abstract of a paper presented at the 28th Annual Purdue Road School, Jan. 22, 1942, are sound and constructive.

The maneuvers were held in the southwest quarter of Louisiana and in a narrow strip of southeastern Texas just west of the Sabine River. This area between the Red and Sabine Rivers forms to some extent a triangle which narrows rapidly on the north as these two rivers get closer together, as is the case near Shreveport.

The country is low. Lake Charles, Louisiana, which was the Headquarters of the Third Army for a long time is 9 feet above sea level, and to the north the rise is slight terminating at Shreveport with an elevation of 225 feet.

Between the Red and the Sabine, the principal water course is the Calcasieu River which runs southeast across the area. This is not a formidable stream in itself, but its bottom ground country for a mile or more on each side is nearly an impassable wilderness, and in some cases clearly impassable for even foot troops and their weapons. Infantry has to do some cutting to advance.

Highways in this area are very few and with even fewer highways that can be counted on for motor vehicle movement. US 190 runs along the south border of this area from Kinder to DeQuincy and is a modern concrete pavement with 5-foot shoulders generally, and in a few instances

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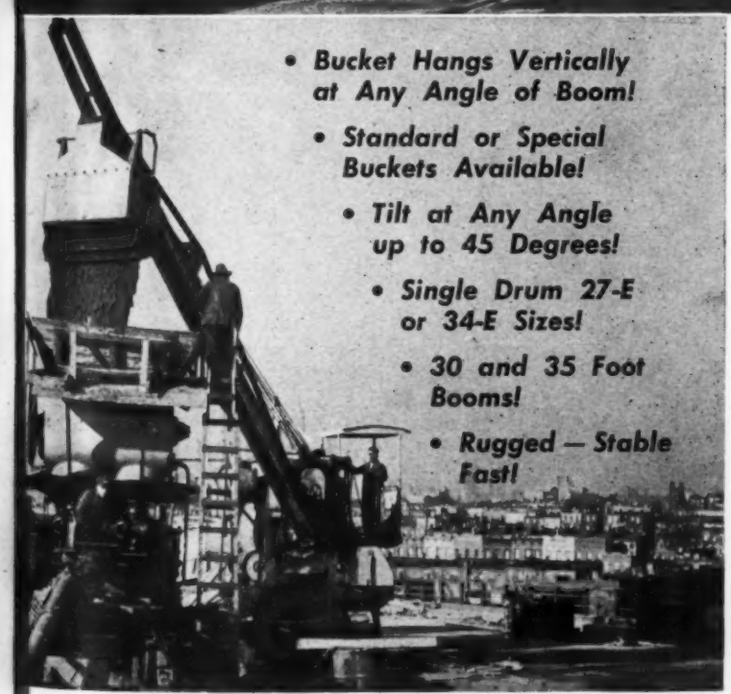

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Above: *The Corbetta Construction Co. made things hum on the Gowanus Parkway, Brooklyn, with a MultiFoote 27-E Inclined Boom Paver with a 35-ft. boom tilted at 45 degrees.*

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15-foot shoulders due to ditch banks being used for the highway and having an excess of fill to start with. U.S. 165 runs north from Kinder to Alexandria and is a good concrete highway. From Alexandria to Shreveport, State Highway 20 is the best route and it is a good secondary road of bituminous material with some concrete sections in it. On the west side U.S. 171 runs from Lake Charles to Shreveport and is a modern highway of both concrete and bituminous construction. The highways I have just described actually bound the area used in the maneuver of the II *vs.* III Army, and while these roads were heavily used, the interior roads of much inferior type were used primarily as the tactical roads over which troops were moved, and over which supplies had to come forward.

There were about 380,000 men involved in this maneuver and about 32,000 vehicles. Here again it was brought home to us that a motor vehicle is not a unit of transportation but a part of a unit and the road is the other part.

Wide shoulders, all-weather surfaces, elimination of bottlenecks, bypasses, strengthened bridges, and a connected network of roads are all-important factors in defensive, as well as offensive military operations. —Editor.

WPA PREFERENCE RATING PROCEDURE

By DIVISION OF INFORMATION
Works Project Administration

DECENTRALIZATION and adherence to simple procedure has enabled the Work Projects Administration to speedily obtain preference ratings for its certified war projects from the War Production Board, facilitating delivery of critical materials and making possible the completion of work schedules in record time.

Since the WPA is a decentralized organization, applications for preference ratings to facilitate delivery of materials to be purchased with WPA funds are submitted directly to the Division of Industry Operations, War Production Board, by the various State Administrators. A minimum of instructions pertinent to application for preference ratings and critical materials have been established by the WPA. These, together with WPB's regulations, are closely followed. As a result the WPA has had little or no difficulty in obtaining materials for construction of access roads, airports, and other facilities essential to the war program.

In addition, considerable amounts of strategic materials have been saved through vigorous cooperation with the WPA in their conservation efforts. All State Administrators have been instructed by the Central WPA Office not to submit project applications involving the use of critical materials when substitutes can be found, and projects are specifically designed to use substitute materials whenever possible.

In directive letters dated July 30 and September 3, 1941, regional and state procurement officers of the Treasury Department were authorized by the Priorities Director of the Office of Production Management to indicate to prospective sources of materials, supplies and equipment, that, upon proper authentication and application, preference ratings would be assigned for certain categories of WPA projects. This list included streets, roads and bridges, certified as important for military or naval purposes by the War or Navy Departments, and connected with military establishments or industrial plants working on war production.

WPA's ability to obtain priority assistance from the WPB is not the result of any WPA application forms demanding special attention, or of any internal WPA procedure. WPA uses the standard forms PD-1A, PD-200 and PD-200A in applying to the board for preference ratings and certificates.

Applications covering the delivery of items purchased with sponsor's funds, involving a single purchase order and embracing issuance of a preference rating certificate, are usually forwarded to the War Production Board by the local sponsor of the project on WPB forms PD-1A—Application for Preference Rating Certificate.

In the event a "blanket" preference rating order is desired for any project, the State Works Projects Administrator submits application to the War Production Board on forms PD-200 and PD-200A — Application for Project Rating. Approval of this application by the WPB will assure deliveries of all materials needed to complete the project, irrespective of whether funds of the WPA or of the sponsor are used to effect the purchases.

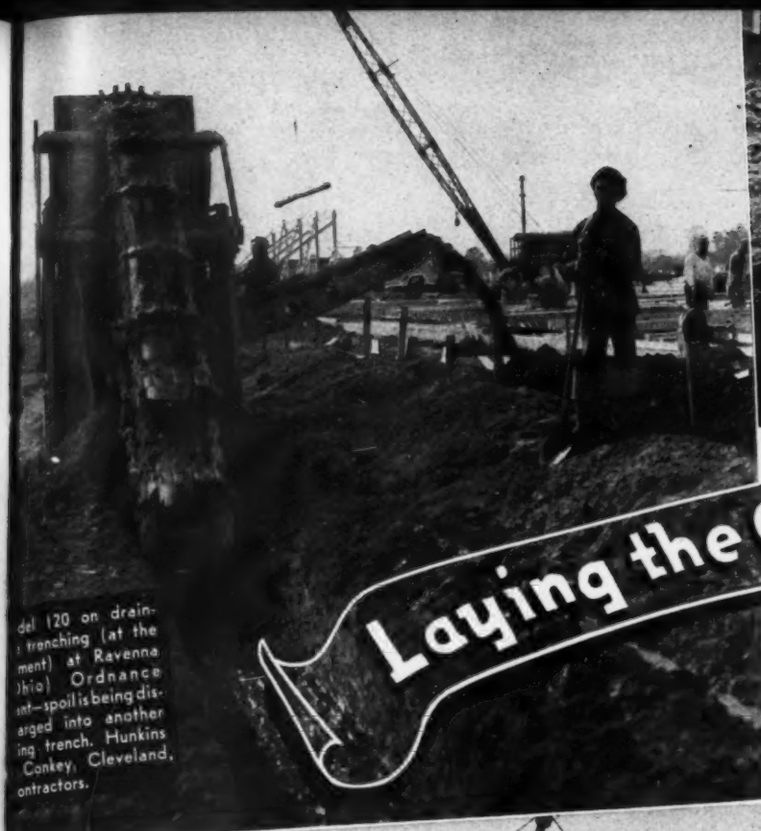
The application forms are utilized for all WPA projects that have been been certified by the War and Navy Departments as vital to national defense and cover construction of airports, hangars, access roads to military establishments, arsenals, and military and naval facilities.

To aid the State Work Project Administrations, the Central Office of the WPA in Washington, D. C., maintains liaison with the War Production Board, and is able to follow up preference rating applications, and furnish the various commodity branches of the War Production Board with additional and detailed information concerning the project for which the priority assistance is required. This is done, however, only after applications have been submitted directly to the WPB, and when a specific request for additional information is made to the Central Office.

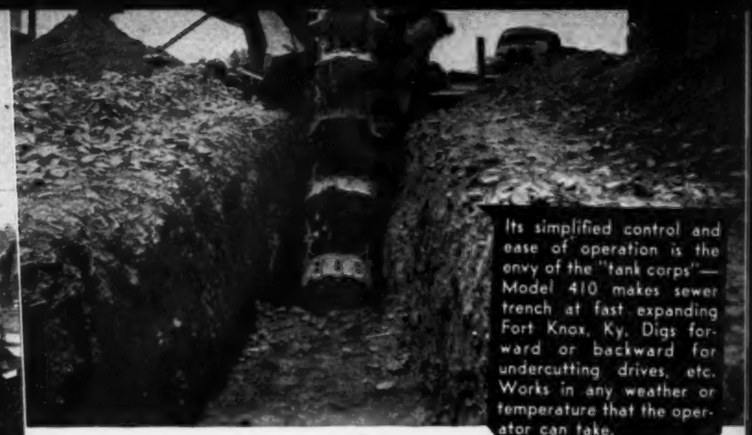
This procedure has been followed by the WPA since the beginning of the war emergency. The extent and importance of the work so executed is partially revealed by the following statistics:

Between July 1, 1940, and February 1, 1942, projects have been put in operation for the construction or improvement of access roads to 159 Army or Navy establishments and 19 important war production plants. In the same period this agency has had under construction or improvement some 430 airports, air bases or landing fields. Of these, 129 are Army or Navy bases or fields and 301 are civil airports that can be used by military or naval fliers.

Thus, in war time as well as peace, the WPA is rendering services that would be difficult of duplication without establishing an organization of similar nature. The experienced organization and adaptability, perfected by the WPA during its existence, has given the WPA an undoubted ability to cope with emergency problems and made possible a unique record of assistance to the armed forces of the country in preparing to fight the Axis.



del 120 on drain- trenching (at the ment) at Ravenna Ohio) Ordnance ant—spoil is being dis- arged into another ing trench. Hunkins Conkey, Cleveland, ontractors.



Its simplified control and ease of operation is the envy of the "tank corps"—Model 410 makes sewer trench at fast expanding Fort Knox, Ky. Digs forward or backward for undercutting drives, etc. Works in any weather or temperature that the operator can take.

Laying the Groundwork for Defense

Flame hardened gears, manganese steel bucket chain links and pins, chrome-nickel steel dual-driven excavator drive shaft are typical of the construction features that will see this "260" through the next couple of World Wars. It's making trench 5' wide by 15' deep on California defense housing sewer main extension.

Ahead of the regiments, the airports, the naval bases, the ordnance plants, had to come—and still have to come—trench for foundation footings, drainage, sewage, water and in some cases gas and electricity. Trench dug so that those championing democracy's cause can train and work under democracy's high standards.

Buckeye Trenchers have shouldered the burden of laying this groundwork for defense and the big, modern Buckeye plant is working at top speed turning out new, fast trenchers so contractors can meet the "deadlines" set by Uncle Sam.

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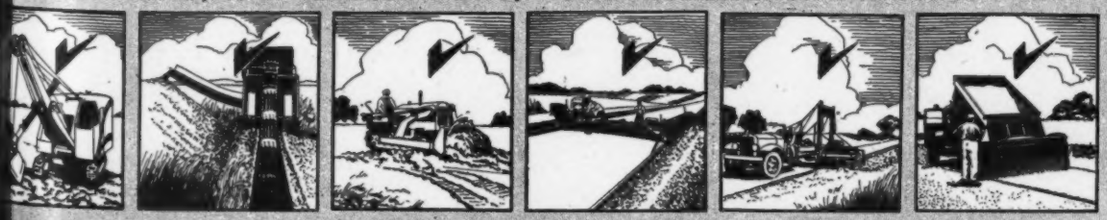

CHECK PAGE 22

Constructing Colorado's First Clover Leaf

By EDGAR F. WILLIAMS
Structural Designer
Colorado State Highway Department

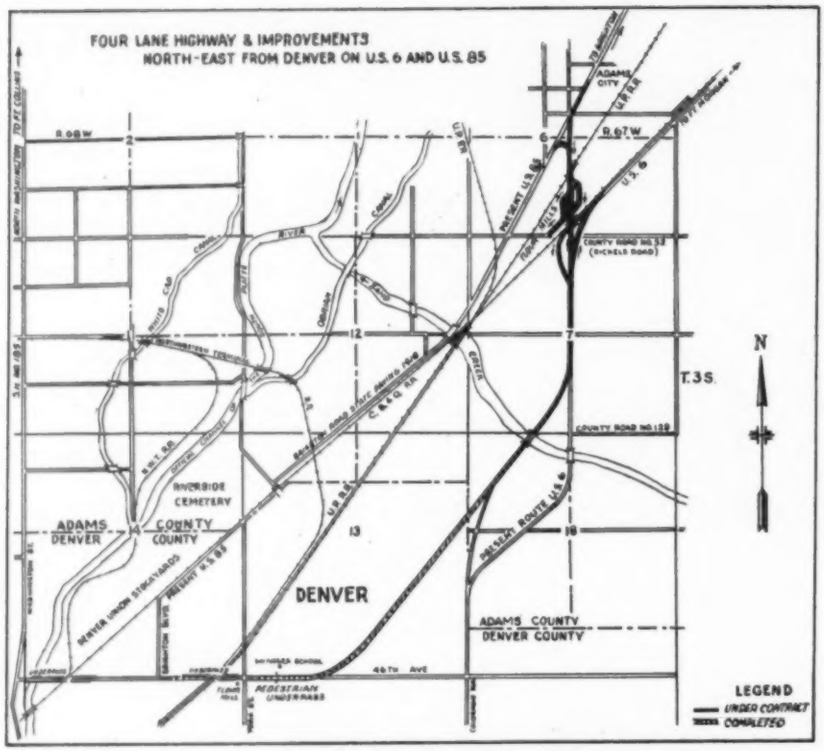

Fig. 1.—General layout of grade separation location

COLORADO'S first clover leaf grade separation, now under construction, will be completed this summer. The site for it was chosen after an extensive study of numerous routes possible. It is the result of a long standing demand for an unrestricted traffic flow north and northeast of Denver, mainly over the original highway U. S. 85 which, during the growth of the city and its industries, has gradually come to be entirely insufficient for traffic demands.

Every one of the routes considered encountered either or both of two railroads, the Union Pacific and the Chicago, Burlington and Quincy Railroads. Also, the new highway had to cross Sand Creek.

At the famous Sand Creek crossing of the two above mentioned railroads

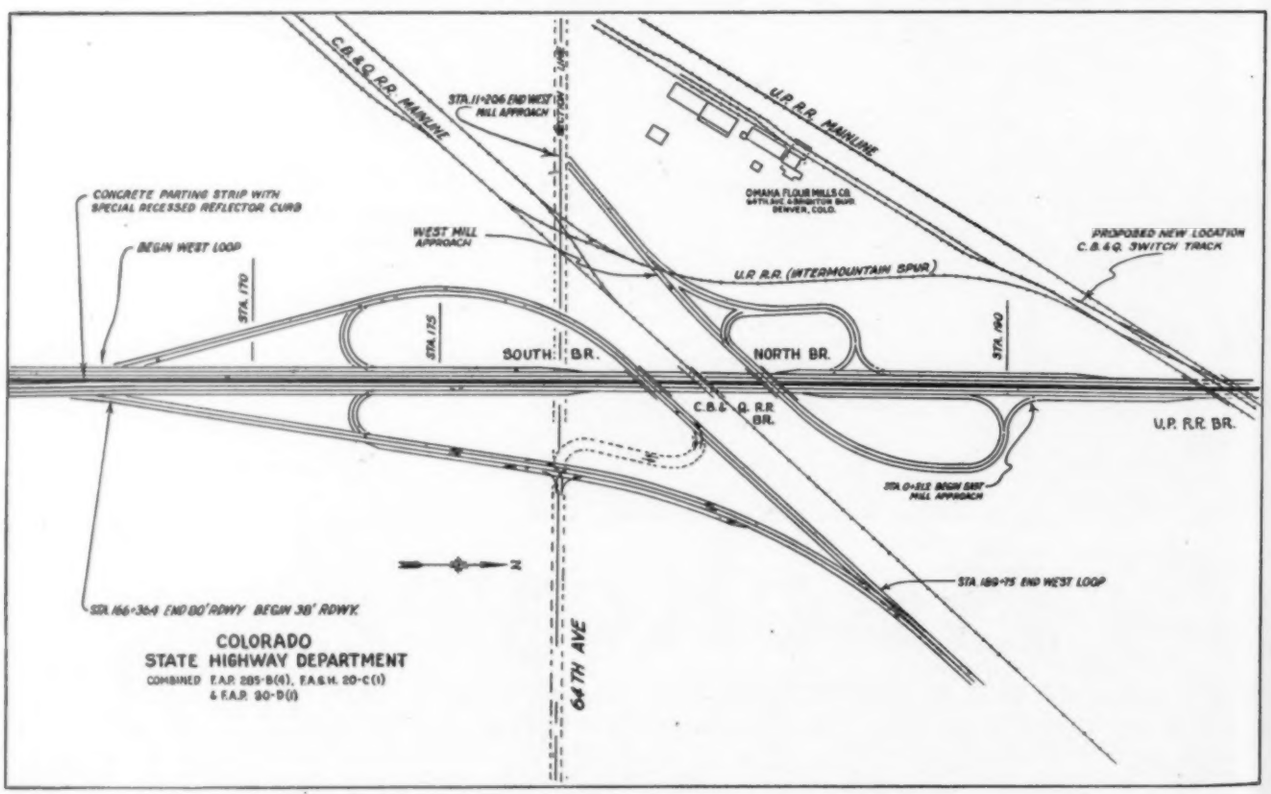

Fig. 2.—General plan of cloverleaf arrangement showing location of the main structures

Fig. 3.—Dragline, trucks and bulldozer beginning excavation work

Fig. 4.—Sand Creek bridge on the approach to the cloverleaf

a viaduct was proposed to cross the creek and jump both railroads in one long structure. In addition to the long costly structure required it proved to make maintenance of the railroad bridges difficult and was abandoned for a site a mile further northeast where State Highway 2 or U. S. 6 joins Colorado Boulevard extension out of Denver. At this point also, an old east and west road called Rickles Road gave access to the Denver Union stockyards and the Omaha Flour Mills Company for near eastern Colorado farmers. The problem here was to bring the traffic on U. S. 6 from Hudson and points easterly on to inbound lanes of U. S. 85 running North and South by crossing over U. S. 85 and joining it in the direction of traffic flow. This also serves to take the Rickles Road patrons into Denver.

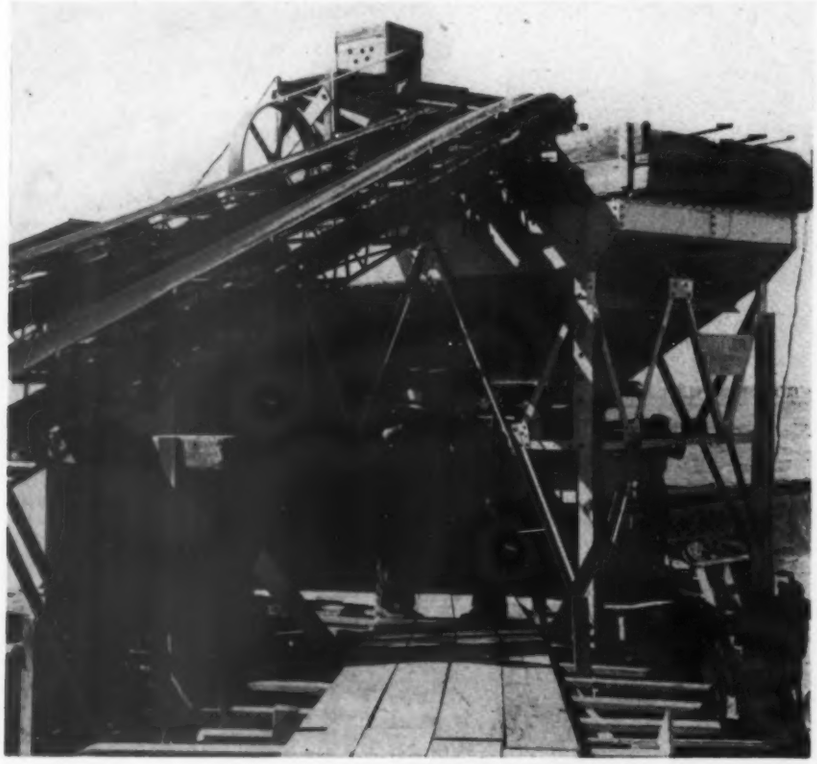

Fig. 5.—Central proportioning and mixing plant setup

The Omaha Flour Mills, being on the West side of the C. B. & Q. R. R., made it necessary to take off of U. S. 85 after crossing under U. S. 6 the C. B. & Q. R. R. bridge and a bridge to provide this traffic over U. S. 85, to reach the Mills.

This arrangement called for three structures parallel to each other and about one hundred feet apart, center line measurement, crossing over the underpass at a skew angle of 41 deg. 41 min. About fifteen hundred feet north of these three bridges is the crossing under the Union Pacific R. R. with the angle of skew 31 deg. Beyond this a quarter of a mile north, the new route of U. S. 85 connects with a "Y" junction to the old Brighton Road, one of Colorado's first paved and certainly most used highways. Here the clover leaf grade separation is unfolding into one of the grandest traffic solutions of the mountain states.

Both railroad grades were raised some few feet to avoid excess cut for the underpass and facilitate the drainage problem.

The clover leaf is described from the highway records as an underpass, though each bridge has its own structure number. For continuity in this description, however, they will be referred to by names designated to them in the preparation of plans for construction, namely, describing from south to north, the South Bridge (handling U. S. 6), the C. B. & Q. R. R. bridge, the North Bridge (serving the Flour Mills), and the Union Pacific R. R. bridge.

Architectural Treatment

The proposed layout was submitted to the two railroads. The railroads submitted designs for their respective structures with a unified architectural appearance. The highway bridges were designed to conform to the same architectural treatment so that bridges, retaining walls and accessory structures will be a unit of continuity in appearance. Handrailings of all bridges are incorporated in the outside girder which is of concrete and referred to as a fascia girder whose primary purpose is to join the rugged abutments with something similar in ruggedness, giving a mass balance.

General Design

Both highway bridges have thirty-foot clear roadways. The South Bridge

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Fig. 6.—Girders and diaphragms of U. P. R.R. bridge. Streamliner City of Denver in background on shoofly track

Fig. 7.—Stringers and diaphragms in place on South Bridge. All placed with a gin pole

Fig. 8.—Abutments of North Bridge under construction. Protection against freezing at right. C. B. & Q. R.R. bridge in background

has been so constructed as to provide for a future widening of fifteen feet additional to take care of growing traffic. The railroad bridges provide the usual railroad clearances practiced by the respective companies. Highway bridges are designed according to the A. A. S. H. O. specifications calling for loadings of "H-15," Class "A." The railroad structures are designed for Cooper's E-72 loadings; the designing having been done by the respective railroad companies.

The underpass proper has two lanes of twenty-four-foot clear roadway separated by a six-foot-wide parting strip of concrete with special recessed reflector curb.

A five-foot sidewalk has been provided on both sides of the underpass and passes through all bridge abutments. The sidewalks are on parallel grades with the roadway but nine inches above to allow proper curbs.

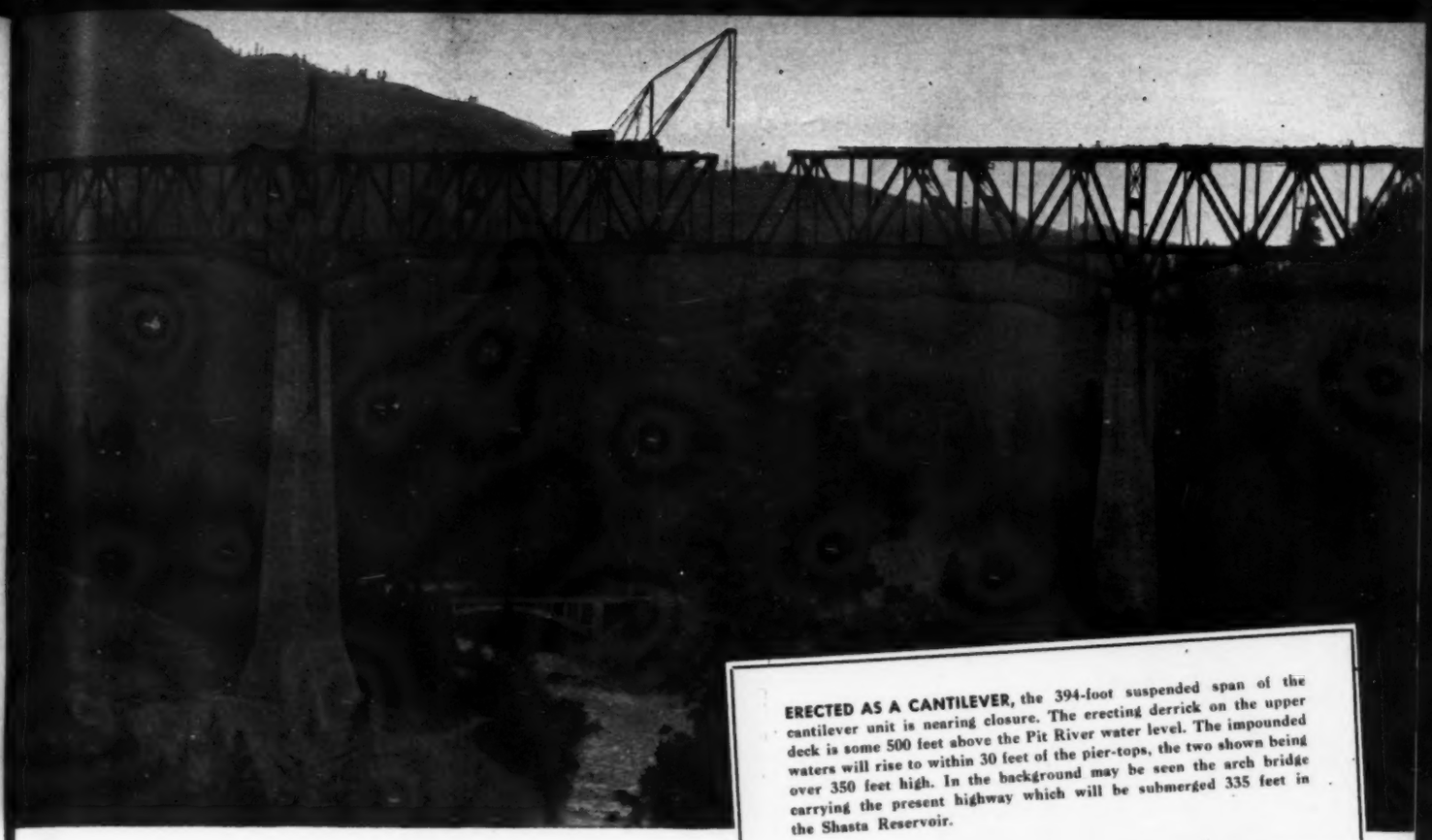
Wing walls of the abutments of adjoining bridges are sloped to conform to two-to-one back slopes at the various skew angles and are connected between adjacent wing ends by retaining walls. This forms a trough between the highway fills and the railroad fill which is drained by special boxes behind the retaining walls.

The abutments of the railroad bridges are designed according to a rigid frame semi-gravity type where mass and weight are predominately necessary. Superstructures of the two railroad bridges are somewhat similar except that the C. B. & Q. R. R. used 36-inch-wide flange beams at 160 pounds per lineal foot on a span of forty-four feet center to center of bearings, where the Union Pacific R. R. used fabricated girders of sixty inches depth on a span of fifty-seven feet six inches, the difference in span being due to a difference in skew angle to the centerline of the roadway. Both bridges have membrane waterproofing under ballast over wrought iron deck plates.

Wrought iron deck plates were field welded at field joints with three passes on continuous welds for the full length of plates joined to girders and diaphragms. The welding was done with two Hobart electric welding machines of 500 amp. capacity.

Both highway structures are alike. The abutments are designed similar to a cantilever wall except that provision was made for a sidewalk passage through the abutments which necessitated the use of a front wall with a single slab over the sidewalk and bearing on the front and back walls. Both walls have a common footer designed to handle the earth forces acting on the wall system.

(Continued on page 62)



ERECTED AS A CANTILEVER, the 394-foot suspended span of the cantilever unit is nearing closure. The erecting derrick on the upper deck is some 500 feet above the Pit River water level. The impounded waters will rise to within 30 feet of the pier-tops, the two shown being over 350 feet high. In the background may be seen the arch bridge carrying the present highway which will be submerged 335 feet in the Shasta Reservoir.

Highest double-deck bridge in the world!

JUST completed, is the closing link in the railroad and highway relocations around the Shasta Reservoir site, the Pit River Bridge. It is located some 14 miles above Redding, California, where the Southern Pacific main line and U. S. Highway No. 99 converge to a common crossing. It spans the deep river gorge which, eventually, will form an arm of the reservoir. Its upper deck carries the 44-foot roadway and 2½-foot sidewalks of the relocated highway. The lower deck carries the double-track relocated railroad.

A notable feature of this two-third-mile long structure is that the highway deck is some 530 feet above the stream bed. Two of the seven concrete piers exceed a height of 350 feet, the tallest being 358 feet—as tall as a 30-story building. Upon completion of Shasta Dam, the backed-up waters will rise to within 30 feet of the pier-tops—a maximum water depth of 400 feet.

American Bridge participated extensively in the steel requirements of both relocation projects. It constructed, previously, five other bridges: the Salt Creek, the First, Third and Fourth Crossings of the Sacramento, the Antler; and now, the outstanding Pit River Bridge which required the fabrication and the erection of some 17,100 tons of steel. Under contract, also, was the installation of the concrete roadway, railings, drainage systems, and the flooring and tracks of the railroad deck.

THE PIT RIVER BRIDGE, built for the U. S. Government Bureau of Reclamation, is approximately 3470 feet long. The double-deck, truss structure consists of two 141-foot and three 282-foot simple spans, and a three-span cantilever unit of two 497-foot anchor arms, two 118-foot cantilever arms and a 394-foot suspended span. Upper-deck highway approaches, on curve with an aggregate length of 714 feet, are deck plate girder spans on steel bents. Girders, ranging from 141 to 154 feet in length, were shipped in one piece, the heaviest weighing 97 tons.

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UNITED STATES STEEL

Truck Rationing Local Alloca-

EFFECTIVE March 9, 1942 no vehicle can be sold, leased, delivered, or otherwise transferred upon a preference rating order, but only upon certificates provided for in the new truck order which is known as General Conservation Order M-100. In other words the new procedure for rationing trucks and commercial vehicles entirely supplants normal priorities operations and henceforth trucks can only be obtained under the new procedure regardless of any preference rating assigned to the project on which the trucks will be used.

The rationing of trucks will be decentralized and carried out through Local Allocation Offices which have been designated by the Office of Defense Transportation. These offices, which are located throughout the United States, are also the field offices of the Bureau of Motor Carriers of the Interstate Commerce Commission. At each of these offices is an official designated as the Local Allocation Officer.

An applicant for a vehicle must first secure an application form PD-310. These will be available at the sales agency handling the make of vehicle designated. After filling out the application the applicant will file the original and one copy with the Local Allocation Officer nearest his principal place of business. After consideration by the Local Officer, the application, if approved, will be forwarded to the Washington office of the Office of Defense Transportation where it will be reviewed. If approved by the Washington office it will be transmitted to the War Production Board for the issuance of a Certificate of Transfer, PD-321, which is issued by the Director of Industry Operations. Upon approval a Certificate of Transfer will be mailed directly to the applicant.

If the application is rejected by the Local Allocation Officer it is so marked and returned to the applicant. If the applicant is aggrieved by the decision of the Local Allocation Officer he has the right to appeal such a decision to the Local Appeal Board. The decision of the Local Appeal Board is final. Appeals must be filed within thirty days after the decision of the Local Allocation Officer.

Communications in regard to appeals should be addressed to the Local Appeal Board, Office of Defense Transportation, in care of the Local Allocation Office which handled the original application.

There follows a list of the Local Allocation Offices of the Office of Defense Transportation.

Local Allocation Offices
Office of Defense Transportation
Washington, D. C.

ALABAMA
Birmingham
1002 Martin Building

ARIZONA
Phoenix
304 Security Building

ARKANSAS
Fort Smith
31 Court House Building
Little Rock
153 U. S. Post Office and Court House

CALIFORNIA
Los Angeles
1519 U. S. Post Office and Court House
San Francisco
541 Monadnock Building

CONNECTICUT
Hartford
202 Essex Building

COLORADO
Denver
622 Midland Savings Building

DELAWARE
Handled at Philadelpia, Pa. Office

DISTRICT OF COLUMBIA
Handled at Baltimore, Md., Office

FLORIDA
Jacksonville
225 Post Office Building
Tallahassee
305 Tallahassee Administration Building

Program and tion Offices

GEORGIA
Atlanta
809 Standard Building

IDAHO
619 Idaho Building

ILLINOIS
Chicago
826 U. S. Court House
Springfield
902 First National Bank Bldg.

INDIANA
Indianapolis
257 U. S. Court House & Post Office
Fort Wayne
359 Federal Building

IOWA
Davenport
615 Kahl Building
Des Moines
221 Federal Office Building

KANSAS
Topeka
309 Federal Building
Wichita
502 Post Office Building

KENTUCKY
Lexington
5 Post Office Building
Louisville
645 Post Office Building

LOUISIANA
New Orleans
633 Federal Building
Shreveport
430 Ricou-Brewster Building

MAINE
Portland
409 Clapp Memorial Building

MARYLAND
Baltimore
401 Appraisers Store Building
Salisbury
206-B Post Office Building

MASSACHUSETTS
Boston
38 Chauncy Street
Springfield
420 Federal Building

MICHIGAN
Detroit
238 Federal Building
Lansing
1608 Olds Tower Building

MINNESOTA
Minneapolis
107 Federal Office Building

MISSISSIPPI
Jackson
811 Deposit Guaranty Bank Bldg.

MISSOURI
Kansas City
912 Baltimore Ave.
St. Louis
920 Boatmen's Bank Building

MONTANA
Billings
413 Electric Building

NEBRASKA
Lincoln
318 U. S. Post Office and Court House
Omaha
802 Woodman of the World Bldg.

NEVADA
Handled at San Francisco, Calif. Office

NEW HAMPSHIRE
Lebanon
6 Campbell Street

NEW JERSEY
Trenton
410 Post Office Building

NEW MEXICO
Albuquerque
401 Sunshine Building

NEW YORK
Albany
417 Federal Building
Binghamton
711 Kilmer Press Building
Buffalo
1501 Genesee Building
New York
Federal Building
641 Washington Street
Syracuse
379 Federal Building

NORTH CAROLINA
Charlotte
240 Post Office Building
Raleigh
307 Post Office Building

NORTH DAKOTA
Fargo
404 First National Bank Bldg.

OHIO
Cincinnati
413 New Federal Building
Cleveland
519 Federal Building
Columbus
311 Old Post Office Building
Toledo
Third Floor Old Federal Bldg.

OKLAHOMA
Oklahoma City
336 Key Building
Tulsa
516 Wright Building

OREGON
Portland
323 Pittock Block

PENNSYLVANIA
Harrisburg
Room 504, 600 N. Second St.
Philadelphia
1101 Gimbel Building
Pittsburgh
1025 New Federal Building
Scranton
329 U. S. Post Office Building

RHODE ISLAND
Providence
508 Palmer Building

SOUTH CAROLINA
Columbia
116 U. S. Court House

SOUTH DAKOTA
Pierre
301 Post Office Building

TENNESSEE
Memphis
207 Post Office Building
Nashville
222 U. S. Court House

TEXAS
Dallas
533 Federal Building
El Paso
103 Federal Building
Fort Worth
1101 Electric Building
Houston
614 New Federal Building
San Antonio
205 U. S. Post Office Building

UTAH
Salt Lake City
420 Continental Bank Building

VERMONT
Handled at Lebanon, N. H., Office

VIRGINIA
Richmond
608 Parcel Post Building
Roanoke
206 Liberty Trust Building

WASHINGTON
Seattle
714½ U. S. Court House
Spokane
206 Post Office Building

WEST VIRGINIA
Charleston
417 Peoples Bank Building
Wheeling
740 National Exchange Bank Building

WISCONSIN
Madison
504 Cantwell Building
Milwaukee
828 N. Broadway

WYOMING
Handled at Denver Colo. Office

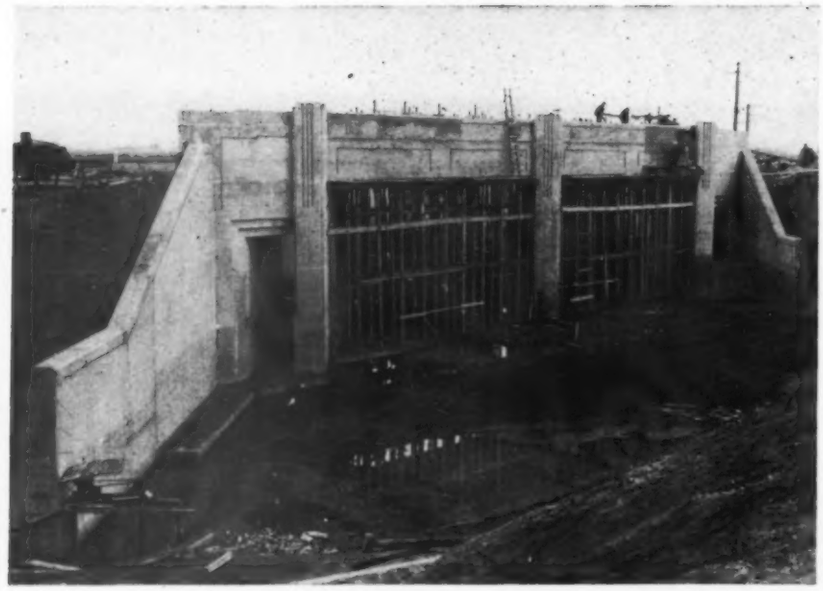

Fig. 9.—C. B. & Q. R.R. bridge showing centering for fascia girder. In left sidewalk tunnel may be seen brackets upon which sidewalk will be placed, while at right, sidewalk is already placed. Note electric dewatering pump at left in foreground

(*Continued from page* 58)

Sidewalk slabs are carried on brackets cast monolithic with the abutment walls.

Superstructures of the highway bridges are reinforced concrete floors on thirty-three-inch-wide flange beams. Drainage from these superstructures is trapped at the bridge ends and piped to the drainage collection system described later.

Construction

Construction has presented many interesting problems. Traffic for construction was one of them and both railroads had to be shoo-flied around the respective structures. The C. B. & Q. R. R. bridge was built first and followed closely with construction of the south highway bridge. Railroad traffic over it was established as soon as possible, allowing the removal of that shoo-fly track and building of the north highway bridge. The Union Pacific R. R. bridge was under construction soon enough to bring completion of it and the highway bridges about the same time.

The heavy excavation of this job was done with a Lima drag line of three-cubic-yard capacity. It was also used with a shovel of the same capacity working into Le Tourneau scrapers of twelve-cubic-yard capacity. This excavation was often taken to one foot above finished grade or to shale where excavation would penetrate it. Large tractor bulldozers were used also where excavated material could be moved from one hole to another or piled between holes.

Despite a heavy underflow of water over shale it was not necessary to use coffer dams but many sumps drained by electric motor driven pumps were required, and the water was kept successfully out of footer pits.

The shale strata under this project ranged in compactness from crumbly clay-like composition to dry, brittle shale but the foundation was uneven and roly so that excavation was carried as much as two and one-half feet deeper than plans called for.

Fig. 11.—U. P. R.R. bridge showing plate girders in place

Fig. 10.—Behind C. B. & Q. R.R. bridge abutment and wing walls showing waterproofing corrugated metal drains from deck to concrete pipes which conduct surface drainage to sump at end of collection system

Concrete for the job was furnished, for the most part, by aggregates from a Butler bin through a Jaeger ½-yard mixer and delivered by a Chain Belt Company Pump-Crete machine capable of delivering twenty cubic yards per hour. It was, however, necessary while pumpcreting to the North Bridge to furnish concrete on the Union Pacific R. R. structure by the use of Rex two-yard transit mixers. A Jaeger one and one-half-yard carrier was also used. At this site ten-cubic-foot buggies were used to deliver concrete from the transit mixers to the forms.

Drainage

The drainage system of this grade separation is designed to carry off surface drainage only. All underground water is sealed out of the drainage pipes. Concrete pipes of twenty-four inch and thirty inch diameter pass behind all abutments

THE "CAT" THAT PURRED 9000 HOURS

NINE THOUSAND hours between overhauls! That would be impressive if it were said about *one* piece of Diesel equipment operating under favorable conditions. Read what Hunkin-Conkey Construction Company says about their experience with RPM Delo in building the U. S. Ordnance plant, Ravenna, Ohio, one of the biggest construction jobs of its kind in the world:

"We have moved in excess of three million cubic yards of dirt, using the following Diesel-powered equipment: 86 tractors, 23 cranes, 11 shovels, 7 locomotives, and 6 power graders. RPM Delo has been used exclusively in every Diesel engine on this job and we have not lost a single bearing in any Diesel.

"Over 30 pieces of Diesel equipment have now passed 9,000 hours of operation, each without an overhaul, and one piece has operated over 10,000 hours and oil consumption is still not excessive.

"Needless to say, we are proud of our maintenance record and are especially pleased with the performance we have had from RPM Delo in our Diesels under severe operating conditions."

At a time when hours are precious, when equipment is almost impossible to replace, Diesel users are swinging more and more to RPM Delo—the oil used by U. S. Navy submarines and approved by the makers of 95% of America's installed Diesel power.

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STANDARD OIL COMPANY OF CALIFORNIA

Fig. 12.—North Bridge pier showing reflector curb and Pumpcrete pipes

carrying water from drain ditches through the backfills. Drain boxes from the bridges and catch basins behind retaining walls empty into these pipes at manholes provided where junctions of drain lines occur. All drainage water is finally collected at the pump sump built at the northeast corner of the Union Pacific R. R. bridge wing wall.

This sump is waterproofed inside and outside and has a capacity of fifty thousand gallons before any possible flooding of the roadway can occur.

Two 5000-gallon per minute Peerless propeller type pumps and one 100-gallon per minute pump are installed with sixteen-inch diameter steel pipes discharging to an open ditch one hundred feet from the pump house. Control switches for these pumps are operated by the electrode system of Bender-Warrick Co.

The fundamental purpose of this drainage and pumping system is to exclude all ground water and subdrainage and handle only surface water due to weather conditions.

Credits

With the exception of the design of the railroad structures all other designs and specifications, drawings and supervision of construction is being done by the Colorado State Highway Department of which Charles D. Vail is State Highway Engineer. Construction of this project is being prosecuted by A. F. Horner and J. H.-N. M. Monaghan of Denver, Colorado, at an approximate cost of $403,000.

Fig. 13.—Special recessed reflector curb parting strip on approach to cloverleaf grade separation. Faceview nearest, back of curb for other roadway just beyond

It's up to American Industry

From all over the world, frightened, helpless eyes peer through the mists of war toward American smokestacks. *Will children die of hunger? Will rifles in men's hands have bullets? Will the air above them swarm with friendly planes . . . or hostile?* It's up to American industry.

Because Koppers cuts across the whole American industrial scene like a common denominator, every new job for American industry puts fresh responsibilities on Koppers and some Koppers product.

Ships gliding down the ways with the hopes of civilization clinging about their bows, have been speeded into the service with bronze propellers from Koppers foundries. The plane soaring protectively above you probably has Koppers piston rings. The carriages of the anti-aircraft guns that rumble comfortingly past on their way to the coast were possibly built by Koppers.

Beneath all these, at the very roots of almost every one of the herculean tasks American industry is performing, is that great storehouse of energy—*coal.*

Koppers is mining vast quantities of coal for fuel. Koppers coke ovens are transforming much of that coal into coke, gas and the flood of other products which eventually mean munitions, drugs, plastics, synthetics, rubber and other indispensables.

With the lives of boys from your home and our homes at stake . . . and the hopes of engulfed nations in the balance . . . every word from an American factory becomes the world's greatest news story. It's up to American industry. Koppers Company, Pittsburgh, Pa.

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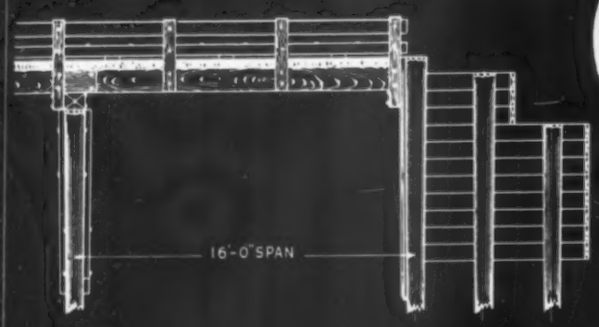
use *Pressure-Creosoted Wood*



ONE COUNTY SAVED 40%. This bridge was built in 1922 by an Alabama county for H-10 loading. Total length: 96′; number of bents: 7; width of roadways: 18′; span length: 16′; cost per sq. ft.: $2.67; total cost of bridge: $4,769.27. Estimated cost if bridge had been built of other permanent materials: $8,000. Saving: 40.5%.

A lot of needed construction, stopped in the project stage by shortages of critical materials, can be completed *now*—with the help of pressure-creosoted wood. Even the prospect of greatly reduced budgets isn't a bar, for pressure-creosoted wood gives a permanent structure at remarkably low initial and annual cost.

For many years, highway departments throughout the country have regularly used pressure-creosoted wood for bridges, culverts, retaining walls, platforms, and similar applications, because of its numerous advantages. Pressure-creosoting makes wood a permanent construction material; many bridges, particularly in heavy railroad service, are still in use after 30 years. Since creosote also gives the wood an enduring "paint job," periodical painting is not required.

Timbers can be completely framed to your specifications prior to treatment, and are easily assembled by your regular maintenance crews without expensive equipment. Construction is often completed in one-fourth the time required with other permanent materials. Structural alterations to meet changing highway conditions can be readily made whenever needed.

Engineering details and comparative costs are given in our bulletin, "Typical Highway Bridges of Pressure-Treated Timber." Ask for a free copy.

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Location and Use of "Flight Strips"

Light bomber using portion of Pennsylvania Turnpike for takeoff in lieu of flight strip in terrain where a flight strip could readily be consrtucted

By LIEUT. COLONEL STEDMAN SHUMWAY HANKS

United States Army Air Forces
Washington, D. C.[1]

JUST what is a "Flight Strip"? Reduced to its simplest terms, a "Flight Strip" is an area for the landing and take-off of aircraft. "Flight Strips" are located adjacent to the public highways, and maintained as a part of the highway right-of-way or roadside development area.

Landing areas are in a very real sense the basis upon which aviation, civil and military, must rest. The "Flight Strip" is a simple answer to our urgent need for more such landing areas, vitally required for the defense of our land in war, and for the maintenance and advancement of aviation at all times.

Administration of the "Flight Strips" Program

Legal basis for the "Flight Strips" program is found in the Defense Highway Act of 1941, approved November 19, 1941. That Act authorizes the Commissioner of Public Roads, in cooperation with the Army Air Corps, to conduct studies and to carry on the construction of "Flight Strips." The acquisition of new or additional lands needed for the program may be included as a part of the construction program, to the extent determined by the Federal Works Administrator, and Federal funds may be used to cover the cost of such acquisition. The Act authorizes an initial appropriation of $10,000,000 for the program, of which $5,000,000 has already been appropriated.* Provision is specifically made that these funds, which may be used without regard to apportionment among the several states, shall be in addition to those available from any other source.

The actual building of "Flight Strips" will be accomplished by the Public Roads Administration. Technical advice and instructions as to the number, location, specifications and general nature of desired "Flight Strips" will be supplied by the Army Air Forces.

The Office of the Chief of the Air Corps recommended on January 16, 1942, that the Commanding General of the Air Force Combat Command issue instructions regarding the location and development of "Flight Strips" to the Commanding Generals of each of the Army Air Forces in the United States. These instructions were dispatched on about January 24th.

In the instructions to our Commanding Generals, attention was invited to the fact that the Commissioner of Public Roads was making four initial allotments of $2,000,000 each for the construction of "Flight Strips" to the Public Roads District Engineers within each of the four Air Force Areas and they were advised that this work would be accomplished with the concurrence and approval of the respective Air Forces concerned.

This work will be coordinated by the Commanding General of each of the four Air Forces in such manner as to prevent duplication of effort, and to insure the strategic placement of "Flight Strips" in the area under his command. In other words, existing facilities will be taken into consideration in planning the construction of "Flight Strips" in order that new sites will be located only when and if existing sites will not completely care for the tactical missions which will be required.

The Air Force Engineer in each of the Air Force areas will coordinate the selection of sites in the Public Roads Districts within his own Air Force area, in terms of total military need, and will approve sites of first priority to the extent of the funds made available to his Area.

It has also been decided that, in accordance with Section 17 of the Defense Highway Act of 1941, Army Officers familiar with the work to be accomplished will be detailed to the Public Roads Administration in the field, to assist in the actual construction and development of "Flight Strips," in accordance with the directions furnished by the Army Air Forces.

Reports will be submitted showing the sites approved, and recommendations as to the additional number of "Flight Strips" which should be provided for will be sent to the authorities in Washington through proper channels.

As this program unfolds and plans are developed, joint meetings will be held with Army Air Force officers at the large pilot training centers throughout the country. Every effort will be made to insure that the location and development of "Flight Strips" will keep pace with the expanding training program, so that there will be adequate auxiliary landing areas, in addition to the main training fields, for our growing Air Forces.

The administrative set-up under which the "Flight Strips" program will function constitutes an obvious departure from methods formerly used in constructing landing areas for aircraft. It vests the job of actually building "Flight Strips," which were designed to be a part of the public roads system, in the Public Roads Administration.

"Flight Strips" Specifications

The term "runway" should not be incorrectly used for a "Flight Strip" because a landing area for aircraft is more than just the ground space required for the runway, apron and other facilities, if any.

Runways should be not less than 150 feet in width for military use. The runways should be not less than 3000 feet in length for the use of pursuit aircraft and not less than 4000 feet in length for the use of all other military aircraft. These lengths are at sea level and are therefore subject to corrections for elevation.

[1] Lt. Col. Stedman presented this as a paper to the February convention of the Association of Highway Officials of the North Atlantic States at Philadelphia.

*Approved December 17, 1941, Public No. 353, 77th Congress.

Terrain in the West where flight strip could not be constructed because of grades involved

A runway of 150-foot width is intended for the landing of one airplane at a time.*

The dimensions of approach to the landing area should provide a suitable angle of approach to the "Flight Strip," extending in a cone-shaped space from the approach end of the runway. This approach area should be kept free of encroachment by high buildings or other obstructions by adequate zoning regulations for the locality surrounding the "Flight Strip," so as to permit approach from either end of the "Flight Strip" runway.

The characteristics of the surrounding terrain may be uneven but the runway itself must be smooth, with a grade of not over 1 per cent for the entire useable area. The surface for the runway, whether paved or sod, should have adequate bearing characteristics. The treatment of the soil may be by some form of stabilization, such as the use of heavy grass turf, with or without soil stabilization.

Runways shall be laid out, wherever possible, in the directions of the prevailing winds, as determined by official wind roses. Official wind rose summaries based on minimum periods of five years, 24 observations a day, are available in most cases or may be interpolated for sites located between Army air base stations where such wind roses have been made.

Communication lines or public utility poles on the near side of the highway right-of-way, or at the end of a runway, should be moved or placed underground. Other such flight-hazards should be placed on the highway right-of-way farthest from the "Flight Strip" area.

In the specifications originally prepared for "Flight Strips" the probable maximum loadings for military airplanes were estimated on the basis of a gross weight of 80 tons for the entire airplane which would mean 40 tons distributed on each of two wheels. The distance from center to center for the tires was stated as an average of 30 feet.

In a letter which I recently received from Mr. Philip Shutler, Director of the State Planning Board for the State of Vermont and a member of the Vermont Aeronautics Board, he inquired both as to the dimensions of the approach zone and the loads per square inch of tire surface to which "Flight Strips" may be expected to be subjected.

Because these same questions may also have occurred to members of other State Planning Boards, Highway Departments or State Departments of Aeronautics, they shall be taken up in order.

The dimension of the approach, in order that a sufficiently long and protected approach zone may be provided, should be taken care of in the original laying out of the "Flight Strip" area. At this time consideration should first be given to obstructions, both natural and artificial outside the boundaries of the "Flight Strip" area. These include mountains, tall buildings, smoke stacks, radio towers, water tanks, and the like.

Poles, houses, rough terrain and highway curvature make this a poor location for a flight strip

Prolongations of the runway on the "Flight Strip" area and of the safe glide paths must clear all such obstructions. Secondly, consideration should be given to topography of the landing area in order to minimize cutting, filling and grading.

The safe glide path outside the "Flight Strip" area on the prolongation of the runway should be, wherever possible, within a trapezoidal area two miles long extending beyond the boundary of the "Flight Strip" area, and in the direction of the center line of the runway prolonged. This

* Note: The area may be 800 ft. by 8000 ft. where the terrain will permit.

Good location for a flight strip is at the right of this Alabama road after removal of a few trees

Here's SISALKRAFT at work

(Top) curing concrete runways for a southwestern bomber plant. *(Above)* half a million square feet of SISALKRAFT blankets on a soil cement airport in the east. Note the simplicity and precision of this method. Many re-uses of the blanket mean low-cost curing.

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trapezoidal area should be not less than 300 feet wide at the boundary of the "Flight Strip" area, and 4000 feet wide at the far limit. Within this trapezoidal area no obstacle should be permitted of sufficient height so as to obstruct an angle of glide of 40 feet horizontal to one foot vertical. In some locations we will probably have to be satisfied with an approach area with a glide angle of 30 to 1. Certain types of lesser obstructions to an otherwise desirable approach, such as trees, power lines, and chimneys, may in some cases be removed or lowered.

Within the "Flight Strip" area itself no obstruction or building should be permitted within 150 feet of the center line of the runway.

At the present time the preliminary layout plans for each "Flight Strip" will normally be prepared in the Office of the District Engineer of the Public Roads Administration charged with the construction of the project in question, in accordance with specifications made available to the Commissioner of Public Roads by the Army Air Forces.

In reply to Mr. Shutler's inquiry as to the load per square inch of tire surface in contact with the runway, the best recognized authorities on this subject believe that new heavy bombardment designs up to and including the Spring of 1944 will call for gross loads of 120,000 pounds, static wheel loads of 60,000 pounds, tire inflations of 70 pounds, impact factors of 25 per cent, with a design stress requirement of 583 pounds per square inch, and a minimum safety factor of 1.20. These design factors will allow from one to three landings per day, if necessary, of the Air Corps new standard heavy bombardment airplane as exemplified in the B-29 airplane.

A question frequently asked is: "Why not widen the highway itself, and use it as a landing area for planes?" General Arnold, Chief of the Army Air Forces, was asked that question when he testified in support of "Flight Strips" before the Senate Committee on Post Offices and Post Roads, in hearings held by that Committee on the Defense Highway Act of 1941 on June 4, 1941. General Arnold pointed out that the highways themselves could not be used for landing aircraft, since this would stop traffic, and that landing on a highway, surrounded by ditches, public-utility poles or other obstructions would be a most hazardous undertaking.

In discussing planning and specifications for "Flight Strips" it is also appropriate to mention the basis upon which the numbers of "Flight Strips" to be developed will be determined.

Poor terrain for a flight strip unless a place may be found in the distant valley. This is a road near Potlach, Idaho, where foundation soil would be suitable

First, the number of "Flight Strips" will of course depend on the type of airplanes and kind of terrain in which Army Air Forces will operate.

Second, the areas to be used for "Flight Strips" for the Army Air Forces will be determined by the nature of the anticipated attack and the location of the theatres of operation. Herr Hitler or Jingo Tojo may be factors in determining these locations, but for the Army Air Forces we hope that we will make that decision, and that it will be overseas.

Third, in general terms, it will be advisable to have one "Flight Strip" for each squadron. A squadron consists of from 12 to 25 airplanes depending on the type of squadron. It will, however, be advisable to have one extra "Flight Strip" for every three squadrons; in other words, using technical terms, for every fighter, interceptor, or bombardment group in the Army Air Forces, four "Flight Strips" will be advisable.

Use of "Flight Strips"

From the military point of view, effective air defense of the United States demands that the "Flight Strips" program be conducted upon a nation-wide basis. Just as there must be organization in depth in order successfully to train pilots, build aircraft, or conduct a successful ground attack, so must there be organization in depth for the landing, take-off and servicing of aircraft.

We must provide a network of landing areas strategically located in all parts of the United States. We must provide interceptor facilities all along our coasts. We must furnish dispersal points for aircraft, to alleviate the crowding of our main air bases and lessen the risk of large-scale bombing losses caused by excessive concentration of aircraft. And we must provide auxiliary landing areas to care for the vast increase in military air traffic.

"Flight Strips" will be no less important in the future of civil aviation. They will provide landing facilities

A well located flight strip could be built on excellent soil along this state road in Rowan County, North Carolina, to the left of the highway

Poor location, poor terrain, poor possibilities for a flight strip along this Indiana road, U. S. 31

for commercial feeder airlines connecting points not now served by airlines, and safe refuge for planes of all types forced down by weather or mechanical difficulties. They will, in addition, provide the ground facilities which will be essential for the tremendous increase in private flying upon which our expanded aircraft industry will inevitably depend for its existence after the war.

As a word of caution.—While we want to keep up a certain amount of competitive spirit and see which states do the best jobs, it is also important to remember that we are at war and that the exact location of he "Flight Strips" should be safeguarded.

Conservation of Critical Materials

Approved by Executive Committee of State Highway Officials' Association

Changes in design and construction standards for the conservation of critical materials have been approved by the Executive Committee of the American Association of State Highway Officials upon recommendation of the Committee on Standards according to a recent issue of *The Constructor*. The announcement stated:

"Upon recommendation of the Committee on Standards of the association, the Executive Committee of the American Association of State Highway Officials, after consultation with the federal Office of Production Management, hereby promulgates changes in association design and construction standards due to the necessity for the conservation of critical materials during the national emergency.

"The critical materials principally involved in road and bridge construction are copper, zinc, steel alloys, carbon steel and other iron products.

"The following changes in specifications for bridges and structures are recommended:

"1. Reduce the allowable unit working stress of concrete f_c to 700 lb. per sq. in.; this working stress to apply to all classes of concrete which have an ultimate compressive strength of 2,400 lb. per sq. in. or better. Some economy can be gained by reducing the amount of cement required in the richer mixes now used. An exception to this would be where it would increase the dead load to such an extent as to require a greater amount of steel, such as a concrete slab on a long steel span. 2. Use a value of n equals 10 for most concrete and 8 if 4,000-lb. concrete is secured. 3. Use reinforced concrete in place of steel in bridge guardrails, I-beams, spans, etc. 4. Make full use of the composite action of concrete floors and beams by using mechanical anchors between floor and beams. 5. Use an allowable working stress for reinforcing steel of f_s equals 22,000 lb. per sq. in. in culverts, abutments, piers, columns and practically all substructures, specifying intermediate grade steel. This would probably call for a more liberal use of waterproofing. 6. Replace heavy steel expansion dams with lighter steel design and concrete cross beams, where practicable. 7. Discourage the use of steel grid floors except in repair jobs and movable spans. 8. Eliminate the use of copper water stops, bronze expansion plates or any copper alloy. Sheet lead can be substituted in some cases. 9. Eliminate the use of aluminum paint and all galvanizing except perhaps galvanized cables and hardware in timber bridges. 10. Eliminate the use of all alloy steels, including silicon. 11. Eliminate the use of steel bearing piles for friction piles. 12. Make greater use of treated timber. 13. Substitute small concrete culverts or concrete or clay pipe in place of corrugated iron pipe culverts. 14. Avoid the addition of reinforcing steel to take compressive stresses in concrete members. 15. Repair existing structures, if practicable, rather than replace them with new structures.

"There is need for the reduction or elimination of steel from concrete pavements and for the substitution of masonry, unreinforced concrete, or concrete or clay pipe for galvanized metal culverts. The use of reinforcement in concrete pavement can be eliminated by the substitution of non-reinforced slabs for reinforced slabs. When such substitution is made it will be necessary to use slab lengths consistent with the design of non-reinforced concrete slabs. In slabs with thickened edges, dowels or other load transferring devices are required at transverse joints. By substituting pavement slabs of uniform thickness for slabs with thickened edges, a reduction of steel across joints may be made inasmuch as provision for load transfer is not required, and only enough steel is necessary across joints to maintain alignment. The elimination of galvanized metal culverts is for the purpose of conserving zinc and iron products. As substitutes for these pipe culverts, box culverts of equivalent capacity are recommended. Such culverts may be constructed with masonry or mass concrete side walls, and with mass or lightly reinforced concrete or arched tops depending upon span and available head rooms. Concrete or clay pipe may also be used. Wherever possible in designs calling for reinforced concrete, substitution of miscellaneous sizes of reinforcing bars instead of design sizes is recommended, in order to utilize such local or regional stocks as may be available, making in the design such redistribution of the steel as use of the miscellaneous sizes available may require. In all new designs involving unavoidable reinforcing, simplification of sizes of reinforcing steel is to be secured by using only ¼-in., ½-in., ¾-in., 1-in., and 1¼-in. deformed rounds. To conserve copper, it is further recommended that lighting projects be entirely eliminated.

Can You Justify Saved Motor Vehicle Time?

By **PROFESSOR HAROLD S. CARTER**
Utah State Agricultural College

SPEED limits above 50 miles per hour appear difficult to justify in the light of recent motor vehicle cost data. High speeds are used to conserve time which is commonly interpreted as having value. Speed surveys quite definitely indicate that few drivers are aware of the high cost of fast driving or that the time saved may actually cost them more than the conserved minutes are worth.

It is the purpose of this article to demonstrate a method for evaluating time saved in terms of the extra vehicle costs inherent in increased speeds. Speed-time cost values may be used to determine vehicle operation rates for lowest cost transportation, to establish fair and reasonable speed limits and to educate drivers to the realization that speed should be reserved for emergencies and high priced business.

In this article Professor Carter has presented a phase of motor vehicle operation destined to receive a great deal more attention in the future than it has in the past. Every driver should have

a thorough understanding of thoughts presented here. Costs for individual operators can be worked out to determine their economy speeds by this procedure.—*Editor.*

Cost Varies As Square of Speed

Costs per mile for gasoline, oil, tires, maintenance and natural depreciation rise with increased speed. This is verified in tests conducted by the Iowa Engineering Experiment Station under the supervision of Professor R. A. Moyer and by records compiled by oil and tire companies. An analysis of these costs reveals a per mile differential cost which varies approximately as the square of the speed.

Time consumed for each mile traveled varies inversely as the speed, while the per mile differential varies inversely as the square of the speed.

Cost differentials in dollars per mile divided by time differentials in hours saved per mile gives the cost rate for each hour saved. These hour saved cost rates are dependent upon relatively accurate cost records which are difficult to obtain for specific conditions. The cost data herein used to demonstrate the determination of the hour saved cost rate for any speed is for an assumed composite automobile. Gasoline and oil costs are based on consumption data furnished through the courtesy of the Utah Oil Refining Company. Tire costs are based on data supplied through the courtesy of the Firestone Tire and Rubber Company. Maintenance and depreciation costs are based on the following assumptions: predominate speed of forty miles per hour throughout a normal life of 100,000 miles; a total maintenance cost of $200.00 during the normal life of the vehicle; original cost $1,000; value of tires $85.00; salvage value $15.00; a differential increase in cost per vehicle mile which varies approximately as the square of the speed. One hundred per cent depreciation, under the above conditions, is considered due to wear and tear. Obsolescense is negligible when the full mileage life of the vehicle is considered. Tire costs are treated separately, consequently their initial cost is deducted along with the salvage value. Table I presents the cost data used in this analysis.

Differential values for time are the difference between the per mile time consumed for successive one mile per hour speeds. The time differential for 30 miles per hour is the difference in time required to travel one mile at 29.5 and 30.5 miles per hour or 0.001111 hours. This value may also be determined by calculus.

Cost Rates of Time Saved

Let t = time in hours
S = speed in miles per hour
then $t = 1/S$
and $dt/dS = -1/S^2$.
When $S = 30$, $t = -1/30^2 = -1/900 = -0.001111$.

Time differentials are shown in column 2 of Table II. It will be noted that these values decrease inversely as the square of the speed.

Cost differentials are the differences between the per mile costs for successive one mile per hour speeds. These differentials may be obtained by scaling the respective per mile cost increase from curves which are constructed from the data in Table I. The cost differential for 30 miles per hour is the scaled increase in cost between 29.5 and 30.5 miles per hour.

TABLE I.—GASOLINE, OIL, TIRE, MAINTENANCE AND DEPRECIATION COSTS FOR AN ASSUMED AUTOMOBILE.

Speed miles per hour	Time per mile hours	Gasoline cost* per mile dollars	Oil cost** per mile dollars	Tire cost*** per mile dollars	Maintenance & depreciation cost per mile dollars
(1)	(2)	(3)	(4)	(5)	(6)
30	0.0333	0.0111	0.0004	0.0021	0.0103
40	0.0250	0.0122	0.0005	0.0028	0.0110
50	0.0200	0.0137	0.0006	0.0037	0.0134
60	0.0167	0.0159	0.0013	0.0048	0.0162
70	0.0143	0.0189	0.0023	0.0067	0.0218
80	0.0125	0.0233	0.0038	0.0106	0.0330

* Cost assumed at 20 cents per gallon.
** Cost assumed at 25 cents per quart.
*** Five tires and tubes assumed to cost $85.00 and to have a life of 40,000 miles at 30 miles per hour.

TABLE II.—COMPOSITE AUTOMOBILE HOUR SAVED COST RATES WITH TIME AND COST DIFFERENTIALS.

Speed miles per hour	Time dif'l hours	Gas, oil tire dif'l costs dollars	Maint. & depr. dif'l costs dollars	Total dif'l costs dollars	Hour Saved Cost Rates Gas, oil tires dollars	Maint. & deprec. dollars	Total dollars
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
30	0.001111	—0.00014	—0.00026	—0.00040	—0.13	—0.23	—0.36
40	0.000625	0.00024	0.00001	0.00025	0.39	—0.02	0.37
50	0.000400	0.00040	0.00024	0.00064	1.00	0.60	1.60
60	0.000278	0.00060	0.00049	0.00109	2.16	1.76	3.92
70	0.000203	0.00089	0.00074	0.00163	4.40	3.65	8.05
80	0.000157	0.00130	0.00099	0.00229	8.32	6.31	14.63

Cost rates presented in columns 6, 7 and 8 of Table II and figure 1 are obtained by dividing the respective values in columns 3, 4 and 5 by the proper time differential in the second column. The total differential cost for 50 miles per hour ($0.00064) divided by the corresponding time differential (0.0004 hours) gives a cost rate for each hour saved of $1.60. Column 8, Table II, and figure 1, shows that 35 miles per hour is about the most efficient speed-time combination for the assumed automobile. The hourly rate rises to $14.63 at 80 miles per hour.

Other costs than those used in this analysis, if affected by the speed, should be included in the determination of the hour saved cost rate. When time saved is used to increase the annual mileage of a vehicle there is a corresponding reduction in the per mile cost for license, taxes, interest, insurance, garage and supervision. This reduction lowers the hour saved cost rate in favor of the higher speeds. An automobile with fixed costs of $200.00 a year, which travels three hundred miles a day for a total of 10,000 miles a year at 30 miles per hour, when considered to travel six hundred miles a day for a total of 20,000 miles a year at 60 miles per hour, would reduce the fixed cost per mile by one cent. The differential cost per mile would be uniform at $0.000333. Time differentials would be as given in Table II. The inclusion of this difference would reduce the hour saved costs from $3.90 to $3.00 approximately.

Cost rates vary with each type of road surface and condition of the respective section of each type. Average values for each type of road surface should be ample refinement for the determination of hour saved cost rates. Bituminous surfaces may have an hour saved cost rate at 50 miles per hour of $1.25 while corresponding gravel road costs might average $2.50 or more.

Each vehicle causes increasing wear and tear on highway surfaces and structures when driven at successively higher speeds. This is a cost which is almost impossible to evaluate and would be infinitesimal per vehicle mile except for certain heavy trucks.

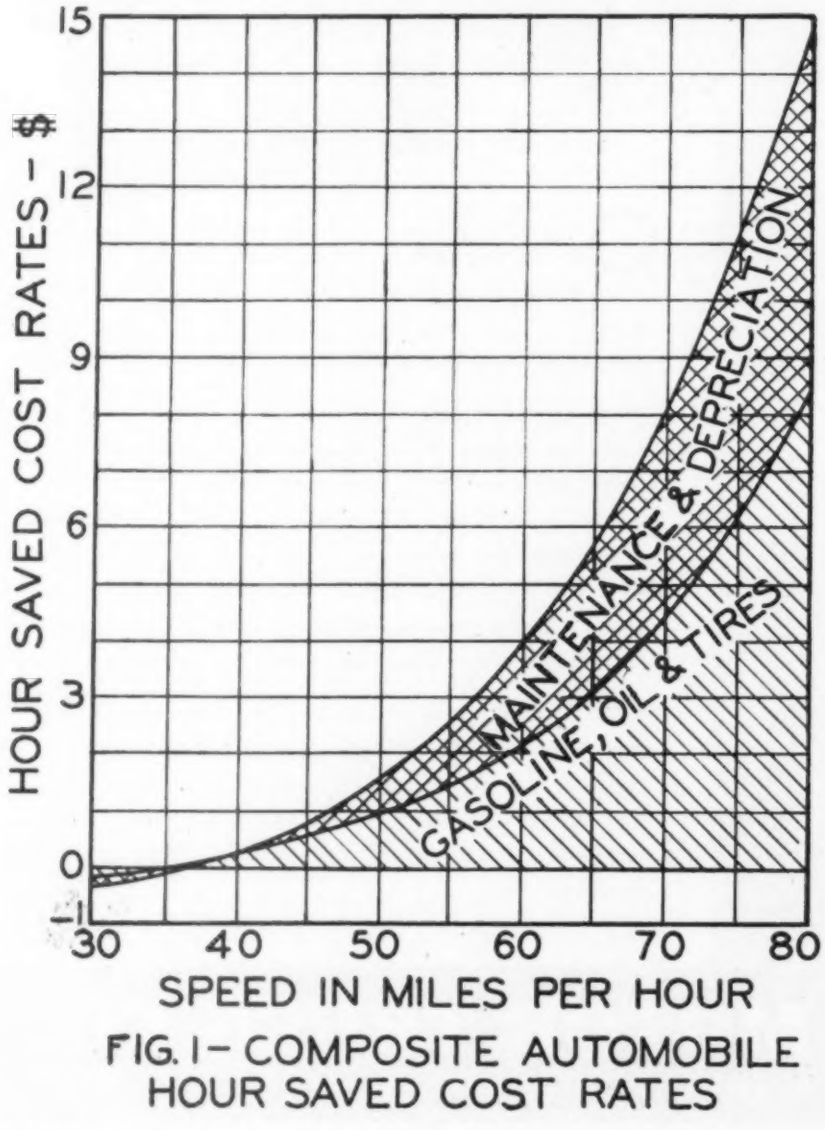


FIG. 1 – COMPOSITE AUTOMOBILE HOUR SAVED COST RATES

Some Conclusions

Hour saved cost rates are rates which indicate the cost just as miles per hour indicate the speed. Between 50 and 60 miles per hour the speed rate is increased 60 minus 50 or 10 miles per hour. The hour saved cost is increased $3.92 minus $1.60 or $2.32 per hour saved by driving 60 instead of 50 miles per hour.

Lowest cost transportation for a vehicle occurs at that speed which has the same hour saved cost rate as the value to the vehicle owner of each hour saved. When the time saved to the owner of the composite vehicle has a value of $1.60 per hour he is economically justified in operating his vehicle at a speed of 50 miles per hour. If his time is worth $15.00 per hour he is economically justified in driving about 80 miles per hour. Full consideration must be given to road conditions, speed regulations and safety.

Speed limits may be selected on the basis of the speed-time economies involved. That speed below which 85 per cent of the vehicles on a highway actually travel is recommended by traffic engineers as the logical speed

limit. In lieu of a speed survey make a per hour time value survey of traffic. Since the hour saved cost rate of a vehicle driven at a given speed equals the per hour time value for lowest cost transportation as explained in the preceding paragraph, the per hour time values may be located on curves similar to the upper curve of figure 1 and the corresponding speeds selected. The selected speed below which 85 per cent of the vehicles fall would be the recommended economy speed limit.

Education of drivers to reserve high speeds for emergencies (and where time values are large) will be simplified through the use of hour saved cost rates. Since each speed has a cost rate per hour the driver can conveniently decide his speedometer setting by the value he places on his time at the instant. This is a form of positive education which is considered the most effective type of education. It can be seen from this that the economy speed for a vehicle will change with the value of the time saved. A truck which has a pay load economy speed of 50 miles per hour may have an empty economy speed of 20 miles per hour. The same situation maintains for all motor vehicles.

Credits

The hour saved cost rate method for evaluating time saved in terms of the extra vehicle costs was first presented by the writer in a talk before a Rotary Club early in 1941. It was elaborated upon in a paper presented at the Utah Highway Engineering Conference in February, 1942. Credit is due Mr. J. H. Sanford, Consulting Engineer, Colorado Springs, Colo., Mr. Foster Kunz, Utah Traffic Engineer and Professor V. H. Tingey, Utah State Agricultural College for constructive help and criticisms.

Intersection Reconstruction Practically Eliminated Accidents

ENGINEERING is accomplishing results in the reduction of accidents on Utah highways. The diagrams herewith show how accidents have been practically completely eliminated at one of Utah's high accident locations, the North Ogden-Hot Springs Junction on U. S. 91. The State Road Commission, through its various departments, conducts studies at all such locations. Based on these studies, necessary corrective measures are effected to eliminate, insofar as possible, the occurrence of accidents.

It is generally known among highway designers that motorists follow lines such as pavement edges, highway center-lines, lane lines, shoulder lines, fence lines or curb lines. The following example indicates how accidents were eliminated by correcting misleading pavement lines and substituting instead those which lead motorists into their proper and safe movements.

Problem.—The intersection of U. S. 91 and a minor road leading to North Ogden was the scene of many accidents resulting from a condition which created confusion in the minds of motorists using this intersection.

Accident Facts.—During the eleven-month period prior to the redesign of this intersection there occurred nine accidents resulting in two deaths, 22 personal injuries, and $4,375 property damage. Accidents occurred at all hours of the day and night.

Field Studies. — Observations indicated that southbound motorists followed the pavement lines extending toward North Ogden. The black oiled surfacing on the south leg of the intersection did not attract the southbound motorist's attention until he was past the center point of the intersection. This confusion combined with high speeds produced severe head-on and head-on side-swipe accidents.

Solution. — Obviously the solution rested in eliminating the misleading lines of concrete to the east. This was accomplished by relocating the minor road so that it intersected at nearly right angles with U. S. 91, and by carrying the oil surfacing material around the curve. Guide posts and three sodium vapor luminaries were also erected as a further precaution against the occurrence of accidents. The total cost of improvement was $2,900.

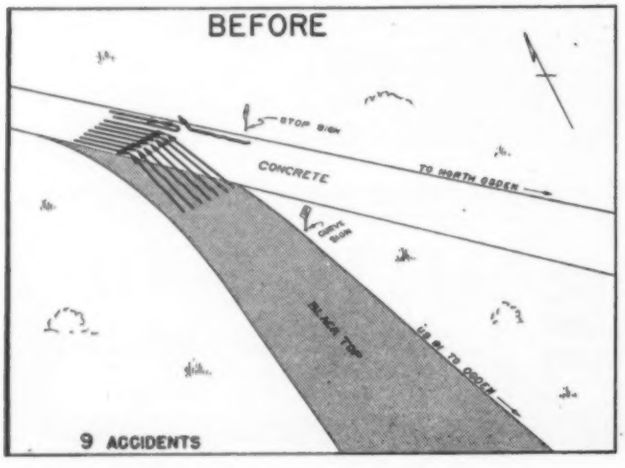
Check Back.—During the 20-month period following the improvement there has been one property damage accident reported as occurring at this location, and that occurred to a drunk who ran off of the road.

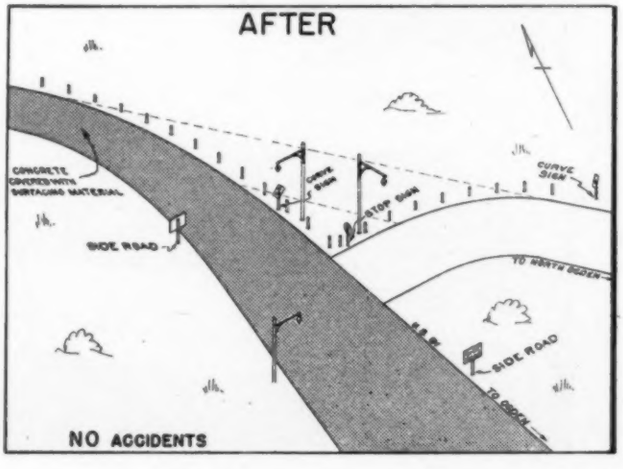
▼

Five States Have Speed Limits of 40 Miles or Under.—Five states will not have to comply to the president's request that maximum speed limits for driving on open highways be reduced to 40 miles. Their speed limits already are 40 miles or under. Massachusetts has a maximum speed limit of 30 miles, while the limit in Rhode Island and Idaho is 35 miles.

▼

Wisconsin Gas Tax Receipts Increase.—Wisconsin gasoline tax collections in February totaled $1,622,609, compared with $1,510,237 in February, 1941. Collections in the first two months of 1942 totaled $3,533,506, compared with $3,136,361 in the corresponding 1941 period.





How Bethlehem Road Joints speed up placing

Bethlehem Road Joints are especially made to save time in placing. They come all in one piece—completely shop-fabricated. Instead of having to take the time to fit a number of parts together into each unit, and then adjust them, you place the one-piece Bethlehem Joint in almost no time at all.

No adjusting is needed on Bethlehem Joints. Dowels are shop-welded to steel spacing bars, parallel and accurately spaced. A third bar welded to the tops of the dowels stabilizes each unit and keeps the dowels firmly and accurately in place. Dowel caps are already in position. And the fiber filler can be quickly fitted into position by one man.

You gain other advantages, too, by using these quick-to-place joints. One or two men can place the unit and anchor it firmly with pins easily driven through the dowels. Also, Bethlehem Joints have such a sturdy, two-sided base that they will not tip over when concrete is dumped against them or when the finishing machine passes over them. And the shape of the unit allows full freedom in working the concrete and in finishing it, so that honeycombs and other common weaknesses in slab structure are completely avoided.

Ask the nearest Bethlehem district office for more facts about these remarkable one-piece road joints that can definitely speed up your paving operations.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

EDITORIAL

You Think You're Too Busy

BUSY as everyone is with the details of their own rush work the value of an editor to the field in which he works begins to stand out in bold relief. This is not written as a boast or in an attempt of the editor to break his arm patting himself on the back. The conditions which exist simply make the statement a fact. Contractors are racingly busy organizing their supply, labor, and equipment in an endeavor to beat the shortened time allowances for the job. Engineers are burning midnight oil to get plans and surveys ready to the point of letting contracts. Neither of these groups are giving the time they should to the technical publication of their field. Personnel changes are occurring daily within the field, changes affecting engineers and contractors yet these men are not aware of what the changes are. They are too busy to read, they feel.

And the manufacturer! If the engineer or contractor thinks he is rushed, if he thinks he cannot afford to take time to read his technical business publication, what about the manufacturers? From personal contact with many manufacturers who make construction equipment it can be stated that they are Rushed, with a capital R. They are neglecting necessary reading to see that the various shift changes are made smoothly, to see that a certain needed alloy rod has arrived, to see that the necessary loan has been made, to chase down and divert equipment in order to meet an *immediate* sailing date, and hundreds of such items. They never have a dull moment and as a consequence they are losing contact with the fields in which they built their businesses.

An editor calling on these engineers, contractors, and manufacturers becomes a walking storehouse of new information in their eyes. He is, but if these men would take out a half hour—quietly—a day, they could keep up with the changes in the field and better provide themselves with information, sorely needed, on which to base a decision they must make tomorrow. That decision may be far reaching in its effect upon the future welfare of that company or individual, yet it must be made. So when an editor of a technical or business periodical calls on an executive today, he is welcomed with open arms and interrogated to the point of taking up too much time.

Under present conditions, the same as under normal conditions, all of the changes, information, developments, reports, news, and investigations pass over the editor's desk. As always, he is sorting, trending, mentally noting, editing, and forwarding these data. Because of the pressure under which his normal audience is working, the editor's meager efforts stand out in bold relief. Fortunate it is, that the industry can afford this service. We hope our readers will take some time daily to read, not only this magazine, but other business magazines in order that they may keep up with the rapidly changing conditions which affect them as individuals and as companies.

CONTRIBUTED EDITORIAL

Where to (and where not to) Use Discarded Wire Rope

***By* F. L. SPANGLER**

Member: American Society of Safety Engineers

WITH Mr. Donald Nelson calling upon all American industry to boost production 25 percent over the present high peak—and with the WPB putting the critical material of steel on an allocation basis—two obvious necessities are: increase the productivity of man and machine hours by the use of quality materials plus safe practices, and conserve steel by making present equipment last longer.

Not long ago the writer had occasion to circularize several thousand industrial engineers, and he took that opportunity to pose a couple of questions. One of those questions was: "To what use do you put discarded or retired wire rope?" The original intent of the question was to find logical ways and means for gaining extra service from a steel product which otherwise would have been sold for scrap. But the returns were both surprising and disconcerting.

Of the 916 replies received, more than 12 per cent of them gave the startling statement that discarded wire rope was being pressed into service as slings. Although the writer has had considerable experience in various divisions of industry, this answer was amazing . . . and alarming because no safety director in my acquaintance would condone the use of worn wire rope for sling use. It is too dangerous. Why? . . . because—

There are too many variables in worn wire rope to permit of its use as a sling. Of the 114 wires in a 6 x 19 wire rope, only 72 wires are visible. It is of course possible to count the number of broken crown wires in any given length of lay to determine the retirement stage of the rope—but such visual inspection does not reveal the number of broken inner-wires,—the places where the core has dried out and collapsed, the spots in the rope that have been weakened by internal corrosion, or many other factors which might make the rope dangerous as a lifting or carrying medium for loads.

Worn and discarded wire rope, in the interest of steel conservation, maintained production, and economy of operation, can and should be put to other uses before sold for scrap.

For applications where rope breakage will not result in a hazard, such as drag cables on dragline excavators, tag lines on bucket cranes, trip cables on power shovels, and drag-scraper cables, discarded rope is not out of place, provided it is of the correct diameter to fit the sheaves, and its construction provides the desired flexibility.

Discarded rope is also serviceable for use as temporary guys, as tow ropes and pull ropes, as guard ropes and fencing, for lashing and binding, and like purposes. Where the rope has to be handled often, rope of the preformed type is less apt to injure the hands since broken wires are not inclined to stick out from preformed rope, whereas with non-preformed rope the ends of broken crown wires create jaggers, which sometimes puncture or lacerate the hands and wrists of those handling the ropes.

Ropes that are discarded because of abrasion, fatigue, or corrosion may be used for the purposes listed above, but they should be avoided for slings. Even where wear has occurred only along a limited length of the rope grave chances are taken in using what appears to be the good section of the rope as sling material.

By avoiding used rope for slings and employing only new preformed rope, one can be assured that the rope strength is not impaired by broken wires or internal corrosion, and that the rope presents no jaggers to injure the hands of those handling it.

Road Equipment Purchases Further Restricted

APRIORITIES release from the American Road Builders' Association states that a recent amendment to Limited Preference Rating Order No. P-19-e, which is issued for highway projects, restricts the use of any preference rating under such an order for the purchase of construction equipment. Henceforth preference ratings applicable to highway projects may be used only for obtaining material which will be physically incorporated into the road project, and of repair parts for construction equipment. A rating assigned by the P-19-e order should only be used for repair parts when the same cannot be obtained by means of the preference rating assigned by Preference Rating Order No. P-100 in time to prevent suspension of operation of the construction equipment. These provisions become retroactive and apply to orders previously issued as well as those in the future.

Accordingly, it is now necessary to make application on form PD-1A for all equipment purchases as well as purchases of materials, other than repair parts, which are not physically incorporated into the particular road project in question.

There follows the order of the War Production Board amending Limited Preference Rating Order No. P-19-e.

TITLE 32—NATIONAL DEFENSE
CHAPTER IX—WAR PRODUCTION BOARD
Subchapter B—DIVISION OF INDUSTRY OPERATIONS

Amendment No. 1 to Limited Preference Rating Order No. P-19-e

By virtue of the authority vested in the Director of Industry Operations, it is hereby ordered that:

(a) All serial numbers of Limited Preference Rating Order No. P-19-e are hereby amended as follows:

(1) Paragraph (a) (4) (i) is amended to read:

"to the Contractor, of Material which will be physically incorporated into the Road Project, and of repair parts for construction equipment, or"

(2) Paragraph (b) (1) is amended to read:

"to the Contractor, of Material which will be physically incorporated into the Road Project, and of repair parts for construction equipment; and"

(3) Paragraph (e) (3) is amended to read:

"to purchase orders or contracts for the purchase of machinery or equipment not to be physically incorporated into the Road Project, provided, however, that the preference rating may be applied to obtain repair parts for construction equipment, if the construction equipment is in active use on the Road Project, and if the repair parts cannot be obtained by means of the Preference Rating assigned by Preference Rating Order No. P-100, in time to prevent suspension of op-

eration of the construction equipment, or"

(4) Paragraph (e)(4) is amended to read:

"to obtain deliveries of Material which will not be physically incorporated into the finished Road Project, except repair parts as specified in paragraph (e)(3), or"

(b) Preference ratings heretofore applied under Limited Preference Rating Order No. P-19-e, to deliveries of Material to which the rating may not be applied under Limited Preference Rating Order No. P-19-e as amended by this amendment, are hereby specifically revoked.

Issued this *6th* day of *March*, 1942.

J. S. Knowlson

Director of Industry Operations

Following is a copy of Preference Rating Order No. P-19-e incorporating the above amendment.

PREFERENCE RATING ORDER No. P-19-e

(As Amended March 7, 1942)

MATERIAL ENTERING INTO THE CONSTRUCTION OF ROAD PROJECTS

To:

Name of Department.....

Address .....

Serial No. .....

PREFERENCE RATING ORDER. For the purpose of facilitating the acquisition of Material for the construction of Road Projects (as hereinafter defined) a preference rating is hereby assigned to deliveries to the Contractor and to his Suppliers upon the following terms:

(a) *Definitions.*

(1) "Department" means the Federal, State or Territorial agency to which this Order is addressed above.

(2) "Road Project" means (statement of type of work and project numbers covered).

(3) "Contractor" means any person who has entered into a contract with the Department for the construction of the Road Project.

(4) "Supplier" means any person with whom a contract or purchase order has been placed for delivery.

(i) to the Contractor, of Material which will be physically incorporated into the Road Project and of repair parts for construction equipment, or

(ii) to another Supplier, of Material which will be physically incorporated into the Road Project.

(5) "Material" means any commodity, equipment accessories, parts, assemblies or products of any kind.

(b) *Assignment of Preference Rating.* Preference rating ..... is hereby assigned to deliveries.

(1) to the Contractor, of Material which will be physically incorporated into the Road Project, and of repair parts for construction equipment; and

(2) to another Supplier, of Material which will be physically incorporated into the Road Project.

(c) *Persons Entitled to Apply Preference Rating.* The preference rating hereby assigned may be applied by:

(1) The Department.

(2) Any Supplier who has been furnished with a signed copy of this Order in the manner specified in paragraph (d).

(d) *Application of Preference Rating.*

(1) The preference rating hereby assigned may not be applied to deliveries to a Contractor except by the Department. In order to apply the preference rating to deliveries to a Contractor, the Department must furnish one copy of the Order to each of the Con-

tractor's Suppliers with whom the Contractor has placed a contract or purchase order for Material to the delivery of which the Department elects to apply the preference rating.

(2) Any Supplier, in order to apply the preference rating to deliveries to him, must

(i) execute a copy of this order by signing the acceptance at the end hereof and file such signed copy with the Division of Priorities, and

(ii) furnish one additional copy of this Order, signed by him in the same manner, to each of his Suppliers with whom he has placed a contract or purchase Order for Material to the delivery of which he elects to apply the preference rating.

(3) After the Department or any Supplier has furnished one such copy to a particular Supplier, he need furnish no additional copy to that Supplier to cover any subsequent deliveries of Material entering into the Road Project. The Department or any Supplier who has applied the rating shall identify subsequent purchase orders which are covered by the rating by specifying thereon the number and serial number of this Order and the preference rating hereby assigned.

(e) *Restrictions on Use of Rating.* The preference rating shall not be applied

(1) unless the Material to be delivered cannot be secured when required without such preference rating,

(2) to obtain deliveries greater in quantity, or on dates earlier than required for the completion on schedule, of the Road Project, or than required in order to make deliveries on schedule of Material which will be physically incorporated into the Road Project,

(3) to purchase orders or contracts for the purchase of machinery or equipment not to be physically incorporated into the Road Project, provided, however, that the preference rating may be applied to obtain repair parts for construction equipment, if the construction equipment is in active use on the Road Project, and if the repair parts cannot be obtained by means of the Preference Rating assigned by Preference Rating Order No. P-100, in time to prevent suspension of operation of the construction equipment, or

(4) to obtain deliveries of Material which will not be physically incorporated into the finished Road Project except repair parts as specified in paragraph (e)(3), or

(5) by any Supplier unless required to complete a delivery by him which has been rated pursuant to this Order.

(f) *Reports and Information.*

(1) The Department and each Supplier who applies the preference rating hereby assigned shall keep and preserve, for a period of at least two years, accurate and complete records and information concerning:

(i) All applications of such preference rating, including the kinds, values, quantities, and delivery dates of Material covered by each such application, together with the name and address of each Supplier to whose deliveries of Material the rating has been applied.

(ii) Inventories and stocks on hand of Material of the kind covered by such application of the rating.

(iii) Contracts and purchase orders on his books, including delivery schedules, for the Road Project, or for Material which will be physically incorporated into the Road Project.

(2) The Department and each Supplier who applies the preference rating shall file reports containing such information concerning the matters specified in paragraph (f) (1) above, and concerning any other pertinent matters, with the Division of Priorities, Office of Production Management, as shall, from time to time, be required by said Division. Until further order, such information shall be furnished to the Division of Priorities on or before the 15th day of each month by the Department and by each supplier on Form PD-81.

(3) The Department and each Supplier who applies the preference rating shall submit, from time to time, to an audit and inspection by representatives of the Division of Priorities concerning the matters specified in paragraph (f) (1), above.

(g) *False Statements.* Any Person who wilfully falsifies records to be kept or information to be furnished pursuant to this Order may be prohibited by the Director of Priorities from receiving further deliveries of any Material subject to allocation by the Director of Priorities, and the Director of Priorities may also take any other action deemed appropriate, including a recommendation for prosecution under section 35-A of the Criminal Code (18 U.S.C. 80).

(h) *Revocation or Modification.* *This Order may be revoked or amended by the Director of Priorities at any time as to the Contractor or any Supplier. In the event of revocation, deliveries already rated pursuant to this Order shall be completed in accordance with said rating, unless the rating has been specifically revoked with respect thereto. No additional applications of the rating to any other deliveries shall thereafter be made by the Contractor or Supplier affected by such revocation.

(i) *Effective Date.* This Order shall take effect immediately, and, unless sooner terminated, shall expire the ..... day of .....194...

(P.D. Reg. 1, Aug. 27, 1941, 6 F.R. 4489; O.P.M. Reg. 3 Amended, Sept. 2, 1941, 6 F.R. 4865; E.O. 8629, Jan. 7, 1941, 6 F.R. 191; E.O. 8875, Aug. 26, 1941, 6 F.R. 4483; sec. 2 (a), Public No. 671, 76th Congress, Third Session, as amended by Public No. 89, 77th Congress, First Session; sec. 9, Public No. 783, 76th Congress, Third Session.)

Issued this ..... day of ..... 194.....

.....
Donald M. Nelson
Director of Priorities

*EDITOR'S NOTE:—Preference ratings applied prior to March 6, 1942, under Limited Preference Rating Order No. P-19-e, to deliveries of Material to which the rating may not be applied under Limited Preference Rating Order No. P-19-e as amended by this amendment, are hereby specifically revoked.

8,000 Miles of Roads Constructed in Army Building Plan.—Colonel Thomas F. Farrell, executive officer, operations branch, construction division, Corps of Engineers, told ARBA delegates at Memphis that over 8,000 miles of roads or their equivalent have been constructed in the army building program. Of this total about 5,000 miles are airbase and airfield construction, 1,300 are in camps and cantonments and 1,700 in ordnance plants and military installations.

About Contractors and Their Jobs

Kansas City Area

REPORTED BY

PAUL L. MATCHETTE

The Koss Construction Co. of Des Moines, Ia., has recently been awarded a contract by the State Highway Commission of Kansas to pave with concrete the Fairfax road. The contract amounted to approximately $157,000. This is the second access road project under the war program to be let so far.

The Koss Construction Co. is one of the large concrete paving contractors throughout the Kansas City district. Mr. Koss has laid perhaps as much concrete highway throughout the State of Missouri as any other contractor operating in Missouri. When Highway No. 66 was paved, from St. Louis to Joplin, Mr. Koss built a large portion of the pavement between Joplin and Springfield, Missouri. The Koss Construction Company is a member of the Missouri A. G. C. They are very active in the organization, and although they hail from Des Moines, Ia., we really consider Mr. Koss and the fine organization that he has with him, Missouri contractors.

Kansas is now counting its entire system of highways. Several months ago, D. J. Fair, Director of the State Highway Commission, announced that in compliance with a request from the Federal Government, all Federal funds available to the Commission would be applied on projects relating to defense needs, military access roads, and the strategic military highway network. The designation of this military highway network roughly crosses the State of Kansas twice north and south and twice east and west.

The Highway Department is devoting practically all its immediate attention to these strategic routes now. New construction will largely be improving these routes, and in building access routes.

Dwight H. Hardman, the well-known and well-liked contractor-aviator from Alton, Kansas, was in Kansas City the other day, taking his examination to obtain a license for the operation of a two-way radio for his airplane.

Dwight Hardman

It is only now and then, that you meet a man that has the energy and the vitality that Dwight Hardman has. Not only is he one of the most successful contractors in the State of Kansas, he is an enthusiastic farmer, owning several thousand acres of land in northwestern Kansas. Then too, Dwight is a politician in his own right. Perhaps we should say that he is a statesman, instead of a politician. He is 100% American, and is out to do everything he can to help our country win the war.

Last year, he built and finished two airports. He is now building another airport, and from all reports, will have this job finished ahead of schedule. He uses his airplane to fly back and forth to his different jobs. By having a license to operate a two-way radio in his plane, he can fly in areas where otherwise he would be barred.

On Feb. 22, 1942, Charles R. DuBois, Road Contractor, Pittsburg, Kan., died. Charles DuBois was well-known throughout this area. He originally came from St. Joseph, Missouri, where he represented that district in the Missouri State Legislature. When the road program got under way in Missouri in the early '20's, Mr. DuBois entered the contracting field and was quite successful in road construction work, bidding on Missouri State Highway projects.

During the World War, Charles DuBois was a Captain in the Army, and became very active in the American Legion. For the past ten years, Captain DuBois has made his headquarters at Pittsburg, Kansas. He was well liked by all of his associates, and his passing is a shock to his many friends.

William B. Honska, pioneer bridge contractor of Salina, Kan., died March 15, at his home in Salina. Bill was 58 years old. He was a civil engineer and bridge contractor. He was a graduate of Kansas State College at Manhattan, Kansas.

Shortly after leaving college, he went to the Philippine Islands, where he did considerable engineering work with the Government. Bill Honska, as he was known by all his friends, was very active in the bridge construction business, and has many large bridges to his credit throughout the State. Bill was one of the best bridge engineers in the business, and many times when the bridge boys got up against tough jobs, they went to Bill for his advice. We will all miss him at the road-lettings. He was a favorite among the men of the construction fraternity. We mention his passing with deep regret.

The Oklahoma State Highway Department is located in the Oklahoma State Capitol Building at Oklahoma City. Directly under the office of Van T. Moon, Chief Engineer of the Oklahoma State Highway Department, is being drilled an oil well. This oil well is being drilled at an angle. The oil well derrick is set directly in front of the State House, and is being drilled at an angle to a distance of more than one mile to a spot directly under Mr. Moon's office.

Mr. W. J. Armstrong, Corporation Commissioner of Oklahoma, said the well might be expected to make 400 to 500 barrels a day, and should produce for years to come. There are now 25 oil wells on state land around the State House. So far it is reported that the State has profited $3,680,000 from these oil wells around the State Capitol.

The State, which leases its lands, does not gain in the oil exploration, but receives its share of the oil produced. Most of the money received goes to the public building fund for new State structures and repairs. A million dollar State office building is now being completed, most of which is being paid from oil funds.

Manhattan-Long Construction Co., contractors for an army camp, are ahead of schedule on their contract, which amounted to approximately $30,000,000.

Stanley Evans, contractor of Fort Smith, Ark., Layman Construction Co., and Standard Paving Co., Tulsa, are working with Manhattan-Long to help finish this project on time. They are producing a large share of the aggregate for the roads.

Recently Stanley Evans negotiated a contract, amount $67,900, for spill-

way improvements on the Grand River Dam near Venita, Okla. The combination of Stanley Evans, Herb Layman, and Vic Gray, is one hard to beat. All of these men are 'go-getters' and are leaders in the construction industry throughout the southwest.

Michigan Area

REPORTED BY

J. M. TELFORD

George W. Koronski, Gogebic County Road Engineer, took office April 1 as president of the Michigan Association of Road Commissioners and Engineers. He succeeded Lee Brooks, Oakland County Road Commissioner.

Other new officers, elected at the annual meeting of the association in Ann Arbor recently, include Ben D. Jeffs, Missaukee County Road Commissioner, and L. F. Levin, Chippewa County Road Engineer, who was re-elected secretary and treasurer.

Directors for the present year, in addition to Mr. Koronski and Mr. Jeffs, are Elmer J. Britt, John H. Dennis, Walter O. Dow, Frank K. Evans, E. K. MacAllister, John F. Breining, E. J. Noreus, Lee Brooks and Carl T. Bowen.

Al Hanen, head of the Detroit Asphalt Paving Company, is recovering from a serious operation.

Several more contracts for construction work in connection with the Davison Limited Highway, being built in Highland Park by the Wayne County Road Commission, have been awarded.

Charles J. Rogers, Inc., was awarded a $327,374.50 contract for a removal of 320,000 cu. yd. of earth to form a cut 14 ft. deep, in which the 6-lane depressed highway will be built.

The W. J. Storen Co., which already was building four bridges over the depressed highway, was awarded another contract for the construction of three more of the structures, to carry Hamilton, Woodward and Oakland avenues over Davison. The latest contract price was $329,957.

It is expected that the new highway will be ready for traffic before the end of the present year. It will be of material benefit to cross-town traffic.

Robert Moses, New York Commissioner of Parks, has been engaged by the Michigan State Highway Department and the Clinton-Huron Metropolitan Authority as a consultant on various phases of limited access highway construction being planned in the Detroit area.

Heavy rains during the third week of March caused considerable damage to roads and structures in several parts of Michigan, particularly in the southwestern and Thumb districts. Roads in many places were flooded to such an extent that traffic had to be re-routed.

John Goulette of Iron Mountain was re-appointed as a member of the Dickinson County Road Commission.

The Port Huron City Commission has approved plans for a 30-block WPA paving program, to cost $58,-361.74.

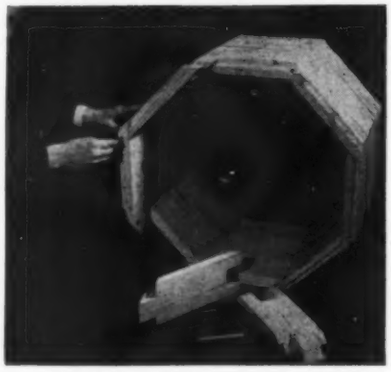
Federal approval authorizing construction of an Industrial Defense Expressway at an estimated cost of $2,500,000, has been received by G. Donald Kennedy, State Highway Commissioner. The project calls for 11.5 miles of two 22-foot concrete lanes and necessary road separation structures.

New Equipment and Materials

New Wartime Drainage Pipe

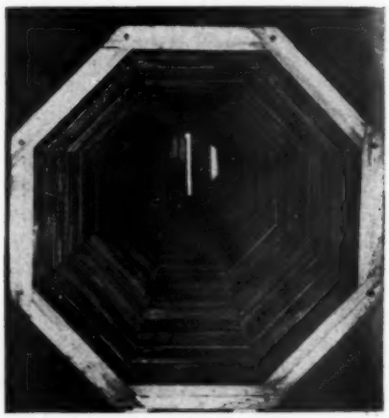
A new Armco emergency pipe has been invented recently by the Armco Drainage Products Association, Middleton, O. It is a wood structure—100 per cent of non-critical materials—requiring no steel bands, nails, nor metal reinforcing of any kind. It goes "all-out" to meet the War Production Board's demand for eliminating critical materials. Wood has the advantage of being reasonably plentiful in most parts of the country; it can be designed for ample strength; it is sufficiently durable for the duration; it

One of the Segments



Assembling the Segments

is light in weight, and it possesses further advantages. Unlike the ordinary box-type of structure which is quite rigid, the opening of the emergency pipe is made up of a series of short stout segments, given an octagonal or other polygonal shape, connected together in an ingenious way to utilize the full strength of the material. Its construction has been likened to that of the Mormon Temple. The units are shop assembled or fabricated into lengths of 12 ft. or more, which in turn are simply joined together in the field to make a single structure. Strength tests show that the emergency pipe possesses many of the structural characteristics of corrugated metal pipe. It has flexibility which enables it to build up side support and increases its load carrying capacity. The thickness of the wood can be varied with the nominal diameter of the pipe. Increased durability is obtained by treating the wood with a non-critical material. It is intended to outlast the 5 to 10 year period for which most of the present army camps and cantonments are being built. On more permanent installations, replacement can readily be made either by threading corrugated metal through it or by jacking a metal pipe around it and removing the old structure. A 4-page folder has been prepared illustrating and describing the features of the emergency pipe. Copies may be obtained from the Armco Drainage Products Asso.



Completed Structure

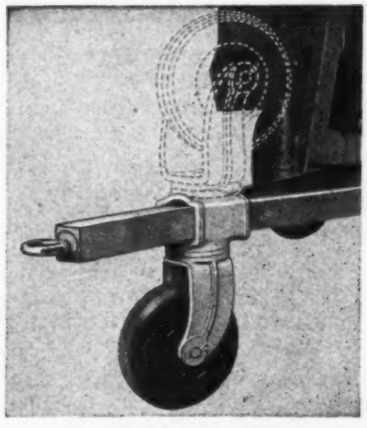
New Welding Rod Developed to Conserve Nickel

To conserve nickel for our war effort, so that it can be used where it will do the most good, the American Manganese Steel Division of The American Brake Shoe & Foundry Co., Chicago Heights, Ill., now has available a new manganese steel welding rod known as V-Mang. An alloy steel containing 12 to 14 per cent manganese, molybdenum and other elements, this electrode has resulted from research started by Amsco's metallurgists several years back looking for a better welding rod. It will replace Amsco Nickel-manganese steel electrodes, except in a few exceptional cases, thus conserving this critical metal without hampering reclamation of manganese steel and other ferrous equipment parts, so necessary at this time. While molybdenum is costlier than nickel, V-Mang rod will be priced the same as Amsco nickel-manganese steel rod. V-Mang can be used to repair fractures in manganese steel parts, as

well as for build-up work, depositing a uniform bead similar to that afforded by nickel-manganese electrodes. V-Mang does not replace Amsco Mo-Mang; a high manganese, high carbon, molybdenum rod that is not as ductile as the new rod and is recommended for build-up work only. V-Mang is available bare and coated in ⅛-in., 5/32-in., 3/16-in. and ¼-in., diameters; in 18-in. lengths.

Swivel Third Wheel for 2-Wheel Trailers

As optional equipment on CMC Mixers, Construction Machinery Co., Waterloo, Ia., is now offering a third wheel or caster for 2-wheel trailers. This equipment is available for CMC



CMC Swivel Third Wheel

mixers now in the field and offers important time and labor-saving advantages. This handy CMC third wheel is equipped with valveless pneumatic puncture-proof tire—runs on roller bearings, and the bracket is made of heavy malleable iron. It is quickly reversed on the tongue and turned up out of the way when not in use.

New Units for Concrete Form Work

Richmond Screw Anchor Co., Inc., 836 Liberty Ave., Brooklyn, N. Y., has announced four additions to their extensive line of concrete form-tying devices and accessories.

One of these is a base plate adjusting clamp which proves more positive and accurate in work than stone chips or wedges. An important feature is that the adjusting clamp units are removable when grout sets and can be reused time after time.

Another is a new type of adjustable screed chair for slabs on fill. This unit is mounted on a swivel and is available for either sound fill or loose fill as required. These are available in three sizes, ranging in chair

height from 2½ in. to 5½ in. and cover a wide range of slab thicknesses. They also provide a convenient range of adjustments to meet varying conditions.

A third new unit is a screed chair similar in many respects to the above type except that it has the additional advantage of an adjustable head mounted on a swivel, offering a number of operating advantages.

The fourth item is an adjustable column clamp made of malleable iron for strength and safety of assembly. This can be used with lumber or steel forms with or without stiffeners. The two-piece clamp is adjustable for columns 8 in. square to 12 in. square including lumber. They weigh 4 lb. each. Nine inches of tough lag threads on each rod permits speed in erection and stripping. Nuts are fixed to prevent removal.

New Hydraulic Control Unit

The Road Machinery Division of Gar Wood Industries, Inc., Detroit, Mich., has announced the production of a new-type hydraulic control unit for operating heavy-duty, dirt-moving machinery drawn by industrial track-type tractors. The unit converts mechanical power from the tractor motor to flexible hydraulic power for transmission to the hydraulic jacks on earth-moving scrapers, road-builders, bulldozers and rippers. The power for the unit is taken from the tractor motor through a direct shaft connection to the pump, either from the transmission shaft of the tractor in the rear or from the motor crankshaft in front. Control unit mounted at the rear (see circle) of an Allis-Chalmers track-type tractor.

Hydraulic Control Unit

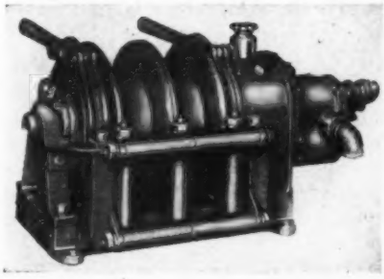
New Dynamite Cartridge Requires No Slitting

A new dynamite cartridge which will expand under tamping to fill the bore hole and concentrate the charge has been developed by the Explosives Department of Hercules Powder Co., Wilmington, Del. The new cartridge, called "Tamptite," eliminates the necessity of slitting cartridges, and permits concentration of a charge within the hole with little or no spillage of powder. Dynamite in the new cartridge is packed in a waxed paper shell having a line of perforations spiraled around the dynamite stick. It contains the same weight of paper as a standard shell. The line of perforations is located between inner and outer layers of paper so that there is no direct track through which moisture might enter or ingredients leak out. The shell is not weakened to the point where priming is difficult, and the cartridges stand up in shipping and handling on the job as well as regular cartridges. When tamped in a bore hole, the cartridge does not open as a slit cartridge does, but unwraps slightly as the cartridge expands to fill the hole. Splitting along the perforated line permits the dynamite to be telescoped to a shortened length while it expands to the diameter of the hole. Even in upper holes where dynamite in slit cartridges often spills, little or no spillage occurs with the new cartridge. The cartridge will

make obsolete the practice of slitting cartridges before loading, the common method of concentrating the charge to obtain better breakage and pull more material. Operations should be speeded by the new shell. All of the Hercules brands and grades commonly used in mining, quarrying, contracting and underground work in sizes up to 1¾ in. in diameter, are available in the new shell.

New Portable Scraper Haulers

Sullivan Machinery Co., Michigan City, Ind., has developed a compact yet powerful scraper hauler S-211, suitable for small jobs or in close workings; for handling ore in preliminary rounds of sub-level drifts, short clean-up jobs in isolated workings, mucking out short cross-cuts, handling waste fill and many similar jobs formerly done by hand. This



New Sullivan Scraper Hauler

hauler is 27 in. long and passes through a 12x14 in. opening. It weighs 250 lb. and is a one-man machine for most operations. Fast rope speed (125 ft. per minute) is developed through the Sullivan patented "Turbinair" motor. Rated rope pull is 1000 lb., but by speeding the motor and suddenly applying the clutch it momentarily pulls more than twice this load—an advantage when scraping large boulders. The S-211 can be equipped with either Turbinair or electric motor.

New Traffic Signal

A new all-steel traffic signal which combines a high-visibility lens with an exclusive phantom-proof feature has been announced by the Lighting Division of the General Electric Co., Schenectady, N. Y. The reflector is made of silvered glass and is specially designed to meet I. T. E. specifications.

The "Internal Sun Phantom" is that characteristic of a signal which makes it appear lighted when in the path of the sun's rays. The phantom-proof nature of the G-E traffic signal eliminates this dangerous characteristic.

WITH THE MANUFACTURERS

Worthington Appoints J. T. Wright Manager Compressor Tool Division

The appointment of Joseph T. Wright as manager of the Compressor and Tool Division at its Holyoke, Mass., Works has been announced by Worthington Pump and Machinery Corporation. Mr. Wright has had a broad experience in the machinery field. He served as assistant works manager of Lodge and Shipley Machine Tool during World War I, subsequently organized J. T. Wright Co. of Cincinnati for the manufacture of paper drilling machines and other special equipment. This organization subsequently merged with Harris-Seybold-Potter Co., Dayton, O., with which organization Mr. Wright served in several responsible capacities.

Timken Adopts War-Time Slogan

"Timken's Job: To Axe the Axis with Axles!" has been adopted by The Timken-Detroit Axle Co. as its war-time slogan and goal. The company

has been operating for nearly two years on a 24-hour, 7-day-a-week schedule. Despite this all-out effort, facilities have been further expanded and production totals continue to climb. Products include axles and brakes for all types of Army vehicles, gun limbers and bogies, transfer cases for multi-wheel drive vehicles, and tank transmissions. For more than 20 years the Timken-Detroit Axle Co. has cooperated with the Quartermaster Corps and Ordnance Department in the planning and development of motorized equipment to meet the Army's grueling requirements.

Thor Expands Service Facilities with Modern Building Program

With the recent removal of its Detroit Branch to its own new building at 15605 Woodrow Wilson Ave., The Independent Pneumatic Tool Co., Chicago, Ill., manufacturers of Thor portable pneumatic tools, continues its expansion of its nationwide service facilities. The opening of the new Detroit building marks the completion of the fourth such new Service Station within the past 15 months. Other newly constructed Thor buildings for branch offices and service

Detroit Service Station and Branch Sales Offices

stations have been opened at Philadelphia, San Francisco and St. Louis. Each of these offices is completely equipped with both men and machines to render prompt and efficient repair and reconditioning service to all users of Thor pneumatic and electric tools in their locality. Headquarters for the branch sales forces, composed of trained tool service engineers, are also maintained at these new offices.

W. S. Scruggs Elected Vice-President

G. A. Bassett, President, St. Paul Hydraulic Hoist Co., Minneapolis, Minn., has announced that W. S. Scruggs has been elected a vice president. Mr. Scruggs who has been connected with the motor truck and hoist industries for the past 25 years, will continue his duties as general manager.

Division Vice-Presidents Announced by Gar Wood

Garfield A. Wood, President, Gar Wood Industries, Inc., Detroit, Michigan, has announced that the following managers have been elected vice-presidents of their divisions: W. H. Hammond, Sales Manager of the Hoist, Body, and Tank Divisions and Director of Branches; J. B. Haile, General Manager of the Road Machinery Division; G. E. Robinson, Manager of the Winch Division. These newly elected vice-presidents will continue their duties as managers of their divisions.

H. O. Penn Machinery Co. Appointed Distributor for Novo

The H. O. Penn Machinery Co., with offices at 140th St. and East River, New York, New York and Jericho Turnpike, Mineola, L. I., and Pleasant Valley Road, Poughkeepsie, New York, have been appointed exclusive distributor for Novo equipment and parts in their territory. They handle the complete line of Novo self-priming centrifugal pumps, diaphragm pumps, pressure pumps, hoists, light plants, pavement breaker and power units.

E. T. Fishwick of Worthington Dies

Edward T. Fishwick, Vice-President and Director of the Worthington Pump and Machinery Corporation died on March 5 at his home in Glen Ridge, N. J. Mr. Fishwick had been with the Worthington organization for 49 years, having started with the corporation at its Cincinnati Works. Mr. Fishwick was senior vice-president of the corporation. He was also president and director of the Worthington-Gamon Meter Co., Newark, New Jersey, a director of the Glen Ridge Trust Company; a director of the New Jersey State Chamber of Commerce and was formerly head of the Diesel Engine Manufacturers Association.

Shovel Company Service Manager Passes Away Suddenly

Ray L. Williams, 55, Service Manager for The Marion Steam Shovel Co., where he was in his 32nd year as an employee, died suddenly of a stroke of apoplexy March 5 at his home in Marion. Mr. Williams became associated with the shovel company on Aug. 15, 1910, as a clerk. For a short time he was in the engineering department and later became repair manager. About ten years ago he was made service manager.

Appoints Advertising Manager

The Cummins Diesel Engine Corporation of New York, 1120 Leggett Ave., New York City, has appointed Charles D. Cavett as advertising and sales promotion manager. Mr. Cavett has been on the copy staff of Spencer W. Curtiss, Inc., Indianapolis industrial agency, for the past three years and prior to that time was engaged in newspaper and publicity work in Ohio, California and New York.

Hercules Re-Elects Officers

Directors of Hercules Powder Co., Wilmington, Del., at their annual organization meeting March 25, re-elected all officers of the company as follows: Russell H. Dunham, chairman of the board; Charles A. Higgins, president; Leavitt N. Bent, Charles A. Bigelow, Petrus W. Meyeringh, Anson B. Nixon, and Gould G. Rheuby, vice-presidents; Raymond N. McAdams, secretary; and Edward B. Morrow, treasurer. The board of directors also re-elected the members of the Executive Committee, Messrs. Higgins, chairman, Bent, Bigelow, Meyeringh, Morrow, and Nixon; and the members of the Finance Committee, Messrs. Dunham, chairman, Higgins, Hoopes, Morrow, Norman, and Rheuby.

A. W. Herrington Appointed Technical Adviser on U. S. Mission to India

Col. Louis Johnson, who was recently appointed special envoy to India, has selected A. W. Herrington of Marmon-Herrington Co., Indianapolis, Ind., as his technical adviser and assistant. This is not Mr. Herrington's first call to his country's service. During the first World War he was an officer in the Motor Transport Corps of the A. E. F. in France, and since that time he has developed many different military vehicles which have been adopted by our own Army, Navy and Marine Corps, and now are seeing service all over the world. He has served many foreign countries, as well as the United States, as a consultant in military mechanization and transportation and takes pride in the fact that most of the countries are now among the United Nations, fighting the Axis.

New Trade Literature

New LeTourneau Folder for Governmental Officials.—Efficient methods and equipment for building defense projects are featured in a new folder released by R. G. LeTourneau, Inc., Peoria, Illinois. This booklet, designed for all county and government construction and earthmoving men, shows the application of Le Tourneau equipment on road and airport construction . . . mining and industrial work.

Earthmoving Job Methods.—R. G. LeTourneau, Inc., Peoria, Ill., has issued a new folder designed to show correct job methods with LeTourneau equipment on every phase of earthmoving or construction work. Featured in the book are photographs taken on the country's biggest and toughest jobs . . . operating and job planning hints for contractors, superintendents and operators.

Safety Markers—The Prismo Safety Corporation, Huntingdon, Penn., has issued a new catalog on safety highways with Prismo. Illustrations and descriptions are given of many installations of Prismo markers for line striping, signs, markers, etc. In the Prismo process numberless little spheres of glass are embedded or partly embedded, the medium being a tough and strong semi-plastic binder. The exposed parts of the glass spheres, acting as tiny lenses, refract and reflect the light from the lamps of a car, and send it back tinged with the color of the binding material.

Detachable Jackbits. — Detachable Jackbits are described in a 2-color, 24-page bulletin announced by Ingersoll-Rand Co., 11 Broadway, New York, N. Y. This new bulletin, which is titled "How Jackbits Reduce Rock Drilling Costs," contains more than fifty illustrations, a table showing the types of Jackbits recommended for different kinds of work, and various cost data.

Tarvia.—A 64-page Tarvia manual has been issued by The Barrett Division, Allied Chemical and Dye Corporation, 40 Rector St., New York. It covers all the ordinary uses of Tarvia and Tarvia-lithic paving materials for both construction and maintenance. The first portion of the manual describes the operations and pavement types in which Tarvia and

Tarvia-lithic are used. The second portion of the manual describes the manner in which the various Tarvia methods may be utilized in the repair and maintenance of different pavement types. Tabulations of Tarvia, Tarvia-lithic, and aggregate sizes have been included.

Earthmoving Equipment.—LeTourneau Earthmoving Equipment 1942 is the title of the new, complete line catalog just released by R. G. Le Tourneau, Inc., Peoria, Ill. 32 pages devoted to equipment model pictures, action photos and condensed specifications on every construction and industrial tool in the LeTourneau line . . . service facilities of the Le Tourneau-"Caterpillar" distributor organization.

Mixer for Low Cost Road Construction.—A new 12-page, 2-color bulletin has been issued detailing the construction and operation of the Wood Roadmixer. This bulletin outlines the Wood Roadmixer traveling plant method of low-cost, rapid construction of asphaltic mats and stabilized bases. Copies of this bulletin may be had by writing to Wood Manufacturing Company, 208 West Eighth Street, Los Angeles, Calif.

All-Wheel Drive Trucks.—A 16-page catalog has been issued by Marmon-Herrington Co., Inc., Indianapolis, Ind., illustrating and describing its 1942 line of all-wheel drive trucks. The catalog shows how the company converts all standard Ford trucks, commercial cars and passenger cars to all-wheel drive. Interesting phantom photographs show how the conversion is made. Specifications are given for 12 models.

Screw Spreaders.—A new bulletin describing the latest Model 10-14 ft. and 20-25 ft. screw spreaders for airport paving and military roads, has just been issued by the Jaeger Machine Co., Columbus, O. Vacuum control for reversing the direction of spreading screw rotation by the movement of a valve is featured on half

width models. Full width models, now in demand for military bases and airport slabs, are equipped with independently controlled right and left hand screw sections, eliminating the need for frequent reversals when spreading. In addition to their ability to spread and strike-off today's skid mixes of as low as ½ in. slump concrete, at a rate exceeding the maximum production of 34E dual drum pavers, reports of highway engineers are submitted emphasizing the remixing and densifying effect of screw spreading and the absence of segregation, stone pockets, and honeycomb observed in screw spread materials. Contractors' reports on numerous jobs, showing production as high as 135 cu. yd. an hour in placing 25 ft. slab and over 122 cu. yd. an hour in 12 ft. slab, are included with the bulletin. On these record runs, the screw spreader was followed by the Jaeger-Lakewood Type H finisher. Reference is also made to the adaptability of the full width spreader to both spread and finish bituminous material. On 40 ft. re-surfacing pavement laid in half sections, two courses, in Cook County, Illinois, the Barberton Construction Co. easily handled 150 tons an hour on both base and top course of 1½ in. compacted thickness. The top was modified sheet asphalt.

Truck Mounted Crane.—A 6-page folder, No. 1928, has been issued by Link-Belt Speeder Corporation, 301 W. Pershing Road, Chicago, on their Model HC-70 truck-mounted crane. Brief specifications, clearance dimensions and lifting capacities are given, including capacities with 30, 40 or 50 ft. long boom, with or without the use of outriggers.

Truck Operators Handbook.—A timely booklet just published by The B. F. Goodrich Co., Akron, O., provides new data on obtaining maximum service from truck tires. The booklet is available at no charge to truck operators upon request. Main feature of the publication is a 15-page section dealing with "Factors Governing Truck Tire Service." Included in the special section of the booklet, are charts and tables portraying the value of proper inflation and loads, the dangers in over- and under-inflation, mis-matching of dual tires, causes of uneven tread wear, and the effect of overloads and excessive speeds in generating heat, prime enemy of rubber. These and other factors are summarized in 20 practical rules showing truck operators how to obtain maximum service life from their truck tires.

CLEARING HOUSE

CLEARING HOUSE

EQUIPMENT FOR SALE

FOR SALE—10B shovel attachment only. Cat. 50 Diesel, 50 gas wide gauge, 35 gas, 60 gas, International TA-40 Trac-TracTor. 18 Fresnos 42 inch. No. 7½ Wonder mixer. Cat. No. 10 Auto Patrol. **Clifford Waterhouse, Jackson, Miss.**

FOR SALE—1 crushing plant complete, including 1 Austin No. 4 gyratory primary crusher, 1 Telsmith No. 2 cone secondary crusher, elevator and revolving screen. Both crushers have new mandrels and bearings. Priced right for immediate sale. **Address Box 467, Roads and Streets, 330 So. Wells St., Chicago, Ill.**

FOR SALE

JAEGER MODEL MP-2, Road Builder Travel Plant, excellent condition, complete with conveying attachment and extension feed auger, also spreading attachment. 150 H.P. Waukesha gasoline engine. FOB a point in Oklahoma. **Address Box 477, Roads and Streets, 330 So. Wells St., Chicago, Ill.**

Barber-Greene Model 848 Travel Plant, excellent used condition, mixer mounted on pneumatic tires. Loader mounted on crawlers. Gasoline power. Located in Kansas. **Address Box 478, Roads and Streets, 330 So. Wells St., Chicago, Ill.**

ATLAS DIESEL POWER UNIT ON SKIDS, 80 H.P., 4 cylinder, 7x8½, completely overhauled. A real buy. **Address Box 479, Roads and Streets, 330 So. Wells St., Chicago, Ill.**

FOR RENT

UNIVERSAL 9"x36" Jaw Rock Crusher. Good used condition. Located in southern Missouri. A bargain. **Address Box 480, Roads and Streets, 330 So. Wells St., Chicago, Ill.**

HELP WANTED

Superintendent or Foreman for Federal, State and City paving, Bridges, Viaducts, heavy and light grading, Interceptor sewers, Waterlines, Foundations, etc., Must have good references and qualifications.

BEN K. STILFIELD CONSTRUCTION CO.
517 Twelfth St., Rock Island, Illinois

POSITION WANTED

POSITION WANTED—Superintendent or Foreman, 10 years' experience on General Construction, bridges, culverts, foundations, concrete masonry, clearing, grading, sewer and water systems, revertment, cofferdams, pile driving, landscape plantings. Good pusher, age 31, draft classification 3-a. Single, Sober, American Citizen. Will go any place. **Box 475, Roads and Streets, 330 So. Wells St., Chicago, Ill.**

POSITION WANTED as Superintendent or Foreman on Bridge and heavy construction, have twelve years experience as Superintendent and foreman and especially experienced on Cofferdams, Piling, Steel Erection and concrete, two years of college in civil engineering, will be available about March 15th or April 1st. Address Box 472, Roads and Streets, 330 So. Wells St., Chicago, Ill.

POSITION WANTED—As Superintendent, Have 30 years experience building all phases of Federal, State and City paving, Bridges, Viaducts, heavy and light grading, Interceptor sewers, water lines, Foundations and flood walls. Familiar with modern equipment. Qualifications cover any project. Organizer and knows cost. Age 47. Best of references. Address Box 465, Roads and Streets, 330 So. Wells St., Chicago, Ill.

INDEX TO ADVERTISERS

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AMERICAN CABLE TRU·LAY *Preformed* IS HELPING

This is no time to have machine shutdowns. By lasting so much longer **TRU-LAY PREFORMED** reduces shutdown frequency and steadies production.

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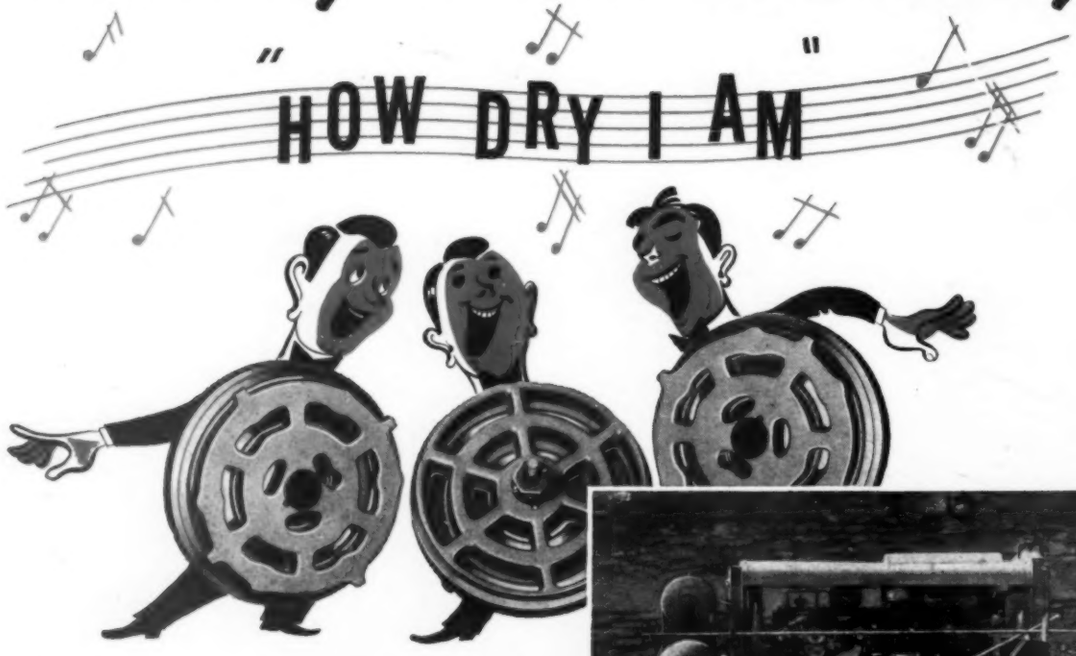
ESSENTIAL PRODUCTS . . . AMERICAN CABLE Wire Rope, TRU-STOP Emergency Brakes, TRU-LAY Control Cables, AMERICAN Chain, WEED Tire Chains, ACCO Malleable Iron Castings, CAMPBELL Cutting Machines, FORD Hoists and Trolleys, HAZARD Wire Rope, Yacht Rigging, Aircraft Control Cables, MANLEY Auto Service Equipment, OWEN Springs, PAGE Fence, Shaped Wire, Welding Wire, READING-PRATT & CADY Valves, READING Electric Steel Castings, WRIGHT Hoists, Cranes, Presses . . . *In Business for Your Safety*

When Compressor Valves Sing...



. . . it's a certain sign that they are getting too little oil, and are liable to pit and rust. "Upon inspection, valve surfaces should have a greasy appearance," say compressor builders.

Too much oil is equally bad, carbonizing, restricting air passages, preventing proper operation.

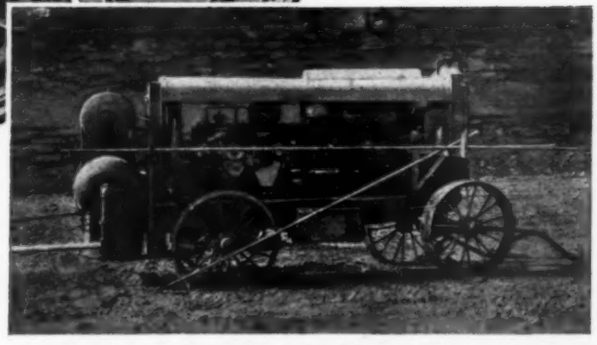
For continued top-performance of your compressors, lubricate with *Texaco Alcaid, Algol, or Ursa Oils.*

These oils resist gumming, sludging, carbonizing. Their use assures efficient valves, free rings, open ports and air lines.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred on prominent construction jobs throughout the country.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write:

The Texas Company, 135 E. 42nd St., N. Y., N. Y.



Ingersoll-Rand Portable Compressor on excavation job. Machines such as this are maintained at high efficiency with minimum of attention when lubricated with Texaco.

THEY PREFER TEXACO

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U.S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U.S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U.S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U.S. are flown with Texaco than with any other brand.

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